



Syntor X 9000 and Syntor X 9000E Mobile Radio Reference Guide

SECTION 1.0

"SECURENET" Digital Capable

"SYNTOR X 9000" CONVENTIONAL MOBILE RADIO

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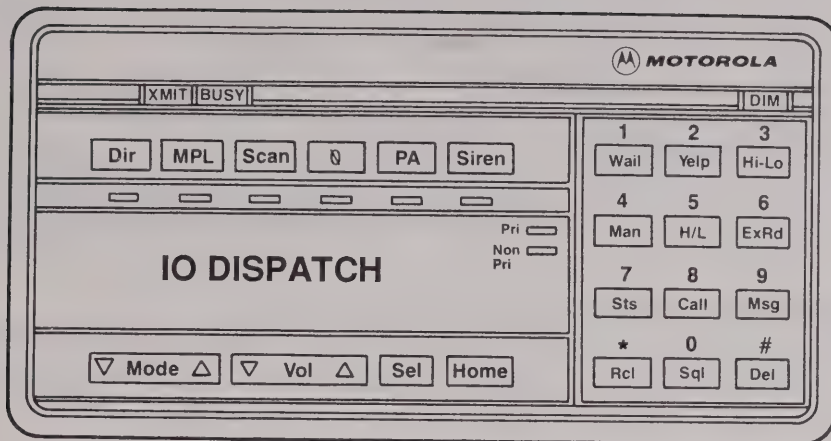
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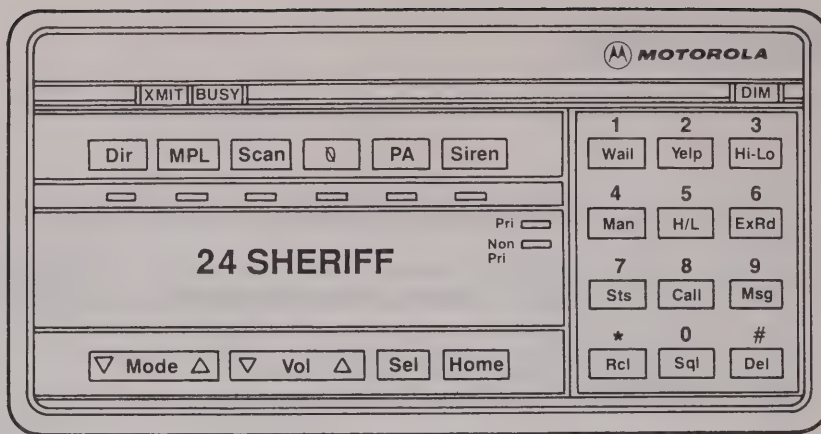
GENERAL FEATURES



CONTROL UNIT

All SYNTOR X 9000 radios come standard with the same size control unit measuring 6.5" by 3.4" by 1.7". This style of control head is referred to as SYSTEMS 9000. The "Systems 9000" Control Head was designed to accommodate the lack of mounting space available in today's smaller vehicles. Multiple options have become a necessity in modern communication systems and SYSTEMS 9000 design has met the challenge. Nearly all of the features and options are controlled from a single compact control unit. The only exceptions are the Auxiliary Switch Panel and Direct Entry Status / Message which, for the convenience of the user, are included in a supplemental housing that mounts directly above the control unit.

Many agencies are selecting smaller vehicles for their fleets due to the high cost of operating a large car. They have found that in many cases there simply wasn't enough room to install a sophisticated radio system and also provide room for the driver, let alone a passenger. They have solved this problem by selecting the SYNTOR X 9000 or 9000E radio which allows them to add the options they need without requiring additional mounting space.



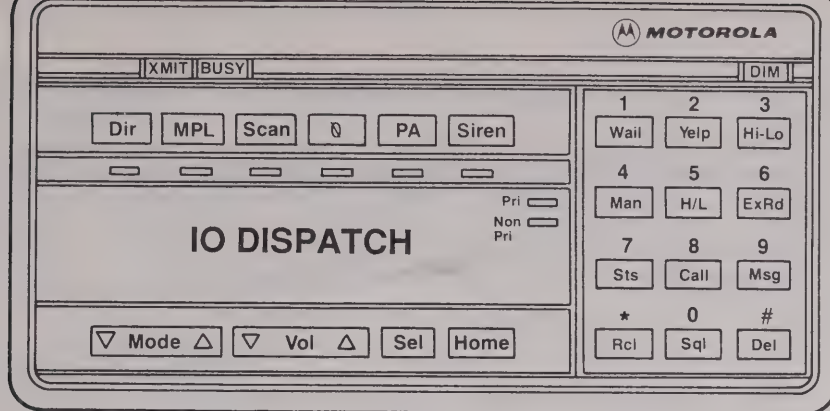
11-CHARACTER ALPHANUMERIC DISPLAY

The Control Unit's ability to display names adds a visual dimension to mobile communications. It allows the user to assign a meaningful name to each operating condition. These names are field programmable and can be changed as often as required.

The SYSTEMS 9000 Control Unit utilizes an eleven-character, vacuum fluorescent, fourteen-segment display for high definition. This design is less susceptible to the affects of wash-out which is a common problem with the traditional LED types of displays.

This electronic directory eliminates the double checking involved when selecting a specific trunked or conventional talkgroup. It also makes it easy to remember a telephone or Private Conversation number since all that is needed is to look for the desired name.

Imagine a Public Safety officer with a 32-mode radio in his vehicle trying to remember what mode the sheriff is operating on. What could be easier than [24 SHERIFF]?



DAY OR NIGHT VISIBILITY

The SYSTEMS 9000 Control Unit provides optimum visibility as a result of its back lit control buttons and channel display. In addition, a Dimmer Control allows the operator to adjust the brightness level depending on ambient light conditions. Four distinct light levels are available including high, medium, low, and off.

This flexibility allows the operator to adjust for bright sunlight conditions or even eliminate all lighting for surveillance applications.

MIL STD 810-D ENVIRONMENTAL PROTECTION

The environmental protection of MIL STD 810-D means both the radio and control unit can survive the most demanding mobile surroundings.

SYNTOR X 9000 radio provides an extra margin of ruggedness for radios used in harsh environments. Dusty construction sites, exposed oil field services and demanding Public Safety users all require a mobile radio that is dependable no matter how tough the conditions are.

The SYNTOR X 9000 radio was designed to meet these types of rugged working conditions and continue operating with true, quality performance.

The radio and the Control Unit will survive the following tests:

MIL 810-D

Rain: 4 inches an hour with a 40 mph wind for two hours, Method 506.2 Procedure 1.

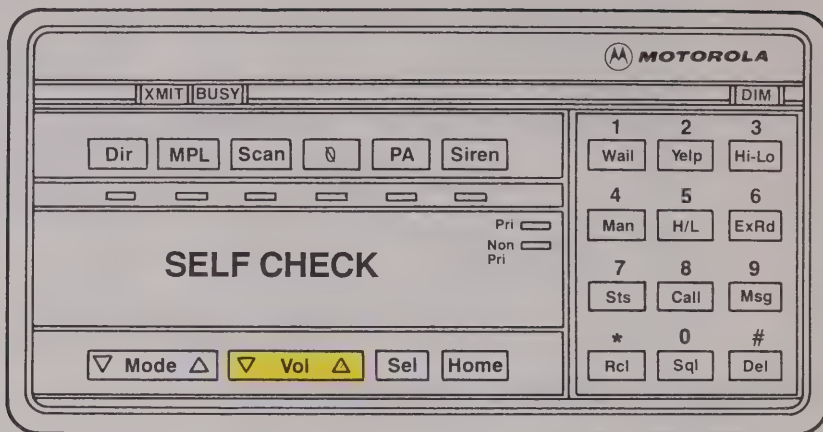
Sand Dust: 28 hours with wind-driven fine sand dust, Method 510.2 Procedure 1.

Salt: 48 hours in corrosive salt fog over a wide range of temperatures and humidity, Method 509.2 Procedure 1.

Shock: While mounted, passes a 30 g shock on all six sides, Method 516.3 Procedure 1.

Vibration: Survives vibration frequencies from 5 to 500 Hz, Method 514.3 Category 8 Figures 514.3-35 & 514.3-36.

STANDARD FEATURES



OFF/ON SWITCH

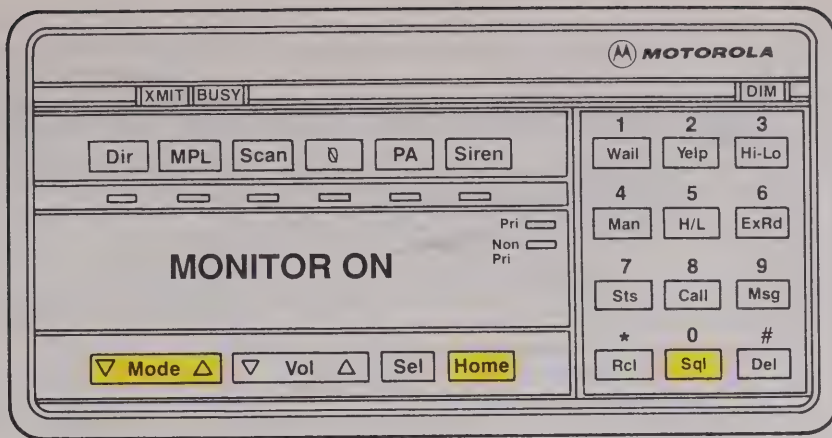
The power switch is a hidden slide switch located on the bottom right side of the Control Unit. This placement helps to prevent accidental turn-offs. Sliding the switch to the left turns the radio on. When powered up, "SELF CHECK" displays and the radio checks itself for proper operation. If a system malfunction is discovered, an error code displays for two seconds. Should the failure prevent the radio from, as an example, talk and listen operation, the Control Unit stops accepting inputs and a fail code displays. These types of malfunctions may or may not prevent the use of the radio (dependent on user programming). In either case see the service department.

VOLUME

The [Vol] rocker switch controls audio volume levels for radio reception. Separate from this, it also sets the public address and external radio volume when these options are selected. For more on this function see **SIREN/PUBLIC ADDRESS**.

To set the volume, simply press the rocker switch's right side to increase audio output or left side to decrease. When pressed, a numerical value 0 through 15 displays to represent the level of output. The level setting is held in memory so turning the radio off and on will not effect the last selection.

If power is lost to the radio, the volume level will return to a factory set or field programmed default level of volume. This setting also determines the minimum volume level of the audible alert tones heard when changing modes, receiving an individual page and selective calls, etc..



SQUELCH

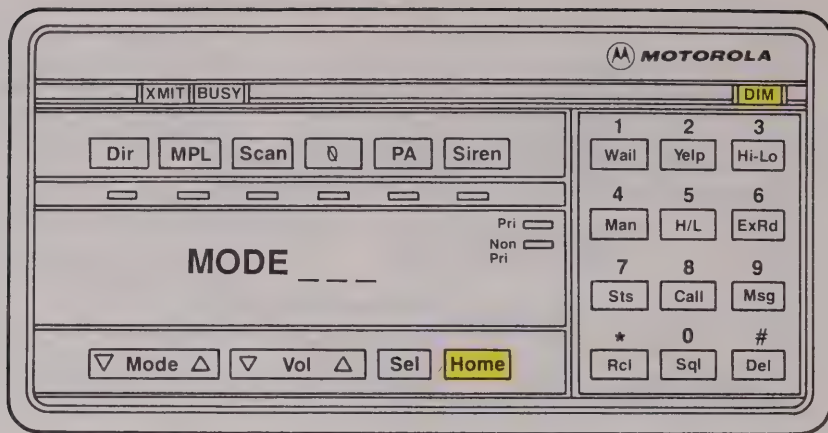
The **[Sql]** button provides two functions. One, it enables and disables the tone-coded squelch separate from the microphone hang-up function. And two, it allows squelch level setting.

When the radio is turned on, the coded squelch will return to the last condition it was in, (enabled or disabled). To enable or disable, press the **[Sql]** button to display either "MONITOR OFF" or "MONITOR ON". The display condition is momentary and reverts back to the currently selected mode name. Taking the microphone off and on hook provides the same function with no display.

To set the squelch level, hold **[Sql]** until a beep sounds. The display shows the current setting 0 through 4; (0 - being unsquelched, 1 - representing the threshold, and 4 - being tight squelched). Pressing **[Mode]** up or down changes the setting. Press **[Home]** to return to the currently selected mode name or wait 60 seconds and it will return itself. If power is lost to the radio, the squelch level will return to a field programmed default level of squelch.

MODE ROCKER SWITCH

Use the **[Mode]** rocker switch to scroll through the list of programmed modes in the radio. During normal operation, the selected field programmed mode name is shown on the radio's display. When the radio is turned on, the mode last selected is displayed. When the mode switch is pressed, a field programmable alert tone is produced to indicate the mode has changed. **[Mode]** is also used in the configuration state as a function in selecting option choices.



HOME

The radio will change to a preprogrammed home mode when **[Home]** is pressed. This is a direct access of mode, regardless of the number of modes between the programmed Home and previously displayed mode.

Rather than scrolling to a desired mode, a direct access may be taken by holding down the **[Home]** button until an audible alert tone is heard. The display will read "MODE _ _ _". From the keypad enter the desired mode number. Press **[Home]** and the selected mode is now displayed.

DIMMER

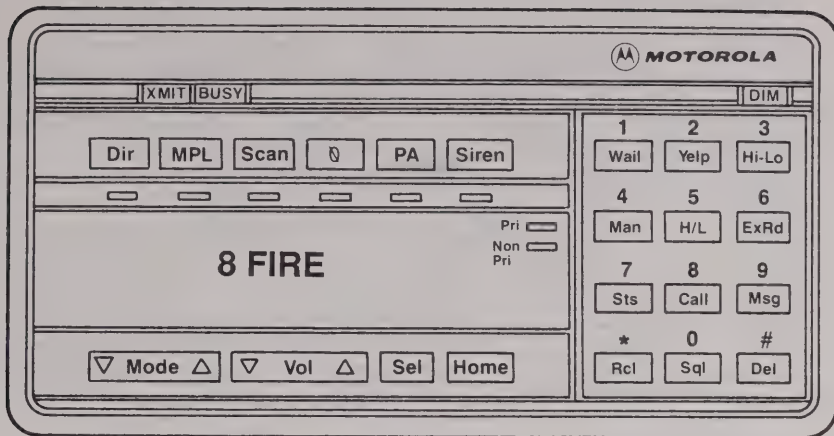
The **[DIM]** button adjusts the brightness of the display to one of four levels. When the radio is turned on, the brightness automatically resets to its highest level. Press **[DIM]** to lower the brightness setting. The lowest setting turns the display, backlit buttons, and even the transmit indicator off for surveillance operation. Pressing the **[DIM]** button one more time returns the brightness to its highest level again.

BROAD BAND OPERATION

The SYNTOR X 9000 radio provides wide space transmit and receive capabilities of up to 19 MHz in Low Band*, 24 MHz in High Band, 20 MHz in the UHF Bands and the entire 800 MHz Conventional Band. No retuning or realignment is needed if frequencies are changed or added.

This wide space capability provides true multiple agency, department or fleet communications anywhere within the frequency range. For example even though the Police, Fire and EMS frequencies may be widely separated they can all communicate with the Broad Band SYNTOR X 9000 radio.

* See Low Band Antennas



PUSH-TO-TALK INHIBIT

This field programmable feature will inhibit operator PTT on a selected mode. This can be used for "data-only" channels or for programmable mode lock out.

INVALID TRANSMIT MODE ALERT TONE

By enabling this field programmable feature an alert tone will sound when the operator attempts to transmit on a mode that, for example, is PTT Inhibited or that has a blank transmit frequency.

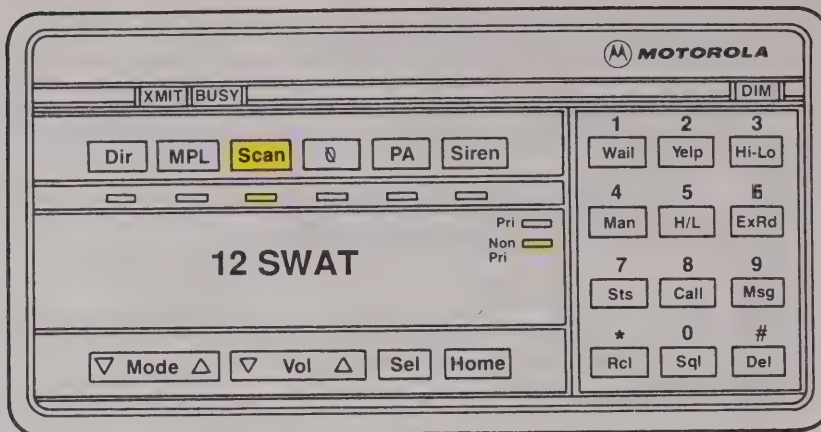
IGNITION SENSE FOR TRANSMITTER

This is a field programmable feature that allows the customer to select one of three conditions when the ignition switch is off.

These conditions are:

1. All transmissions are inhibited which includes voice, operator-initiated signalling, and option-initiated interrogations.
2. All transmissions are uninhibited.
3. Push-to-talk is inhibited.

Note: This feature is not valid if the Orange and Green leads are tied to 'HOT'.



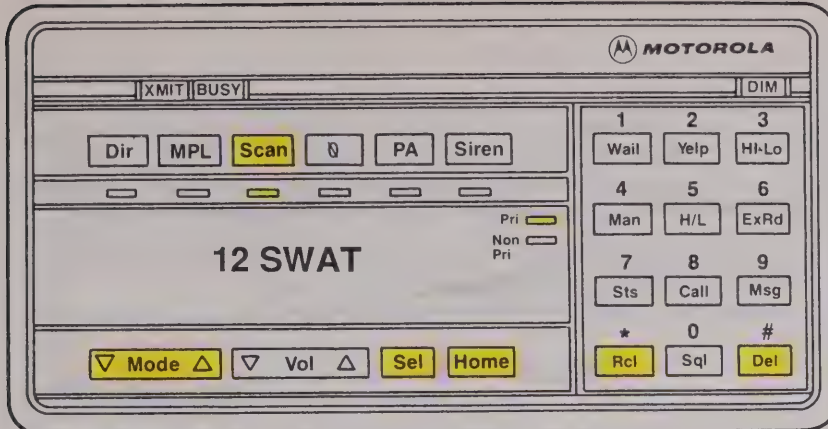
OPERATOR SELECT "CHANNEL SCAN" MONITOR

This feature greatly enhances the channel monitoring operation. It allows the operator to select and adjust a scan list and priority channels that will best serve their individual needs.

Modes can be added or subtracted at any time through operator input to the Control Unit. The scan list can consist of any channel that is programmed into the radio.

In addition to the obvious flexibility of this feature, it is also very simple to use. The ability to display a descriptive name for each mode allows instant recognition of an active channel by the operator.

The size of the scan list is limited only to the number of channels programmed in the radio. One list is allowed per radio. Consideration should be given to the size of the scan list because the larger the list, the slower the effective rate of scan becomes for non-priority channel sampling.



* OPERATING INSTRUCTIONS [Scan]

Scan is turned on and off by pressing the **[Scan]** button. When the scan is on, the red indicator below the button will be lit and the previously selected scan list is enabled.

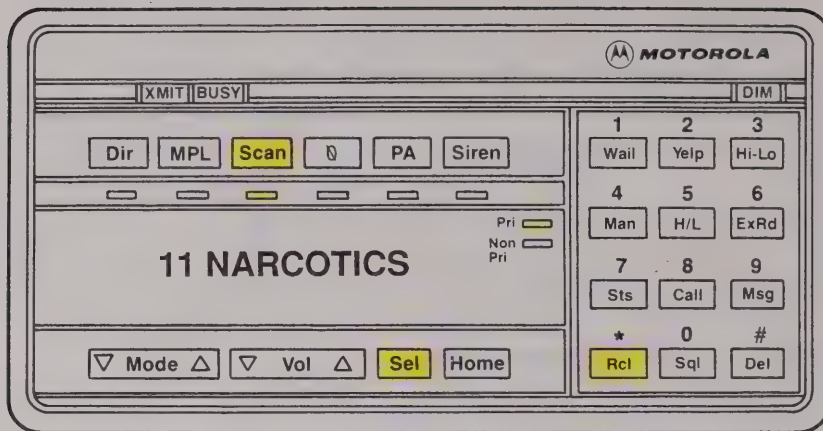
To enter a list, modify or review the existing scan list, press the **[Scan]** button and hold it until an alert tone is heard and the red indicator light begins to flash. Now a new scan list can be entered by either selecting a mode number using the keypad or by using the **[Mode]** rocker to locate a mode name. Either or both priority and non-priority modes may be selectable, depending on how the radio EEPROM is programmed. Once the desired mode name appears on the display, it can be added to the list as a non-priority mode by pressing the **[Sel]** button once, a second priority by pressing the **[Sel]** button twice or as the first priority by pressing the **[Sel]** button three times.

Press [Sel]	Assigns Mode To	Indicator
1 Time	Non-Priority	Non-Priority Lights
2 Times	Second Priority	Priority Lights
3 Times	First Priority	Priority Flashes

Modes may be removed from the list by selecting the undesired mode through keypad entry or mode rocker and then pressing the delete **[Del]** button.

To review the selected list the recall **[Rcl]** button is pressed and held down to scroll through the current scan list. As each mode in the scan list is displayed, its priority will be indicated by the priority and non-priority indicators on the display.

Once scan modifications are complete, pressing the **[Home]** button will exit the scan list entry mode and scan will turn on.



TWO-LEVEL PRIORITY

This field or plant programmable feature adds a second level of priority (P2) to a designated channel in the scan list. If activity exists on P2 it continues to sample P1. If P1 becomes active P2 is not sampled. A non-active channel sequence will be: NP1, P1, P2, NP2, P1, P2, NP3. . . .

DYNAMIC PRIORITY

The Dynamic Priority feature allows the priority of a mode in the scan list to be temporarily modified when the mode is active by pressing the **[Sel]** button. A non-priority mode can be temporarily changed to a second priority.

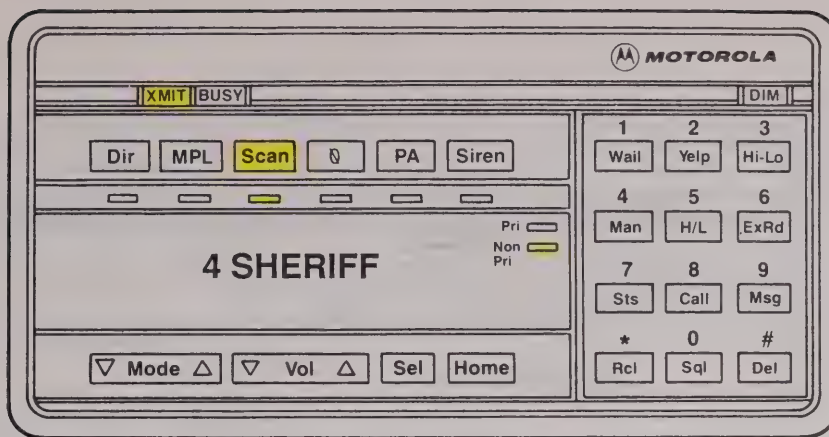
The scan list is restored to the normal priority assignment when the **[Rcl]** button is pressed, the scan is turned off and on, by changing modes, or by turning the radio off and on.

This feature can be enabled or disabled through field programming and is shipped from the factory disabled.

PRIORITY ALERT TONE

Whenever first or second priority channel activity is detected, the operator will be alerted by a short tone as the display changes to indicate the priority mode name.

This is a field programmable feature that allows the customer to have the alert tone activated on both levels of priority, either level of priority or totally disabled. This is not mode driven, so it will be active on all modes or none at all.



TALK BACK SCAN

This enhancement to Channel Scan operation allows the mobile unit to transmit on the last active receive frequency regardless of what mode is selected on the Control Unit. A field programmed variable or factory set 4-second delay occurs after the transmission to allow the operator to "talk back" to that channel without changing the mode selector.

Careful consideration should be given here with respect to delay time, size of scan list in relation to the amount of channel activity and operator specifics. The delay times are referred to as Scan Hang Times. See SCAN HANG TIMES for a definition of this.

This feature can be enabled or disabled through field programming.

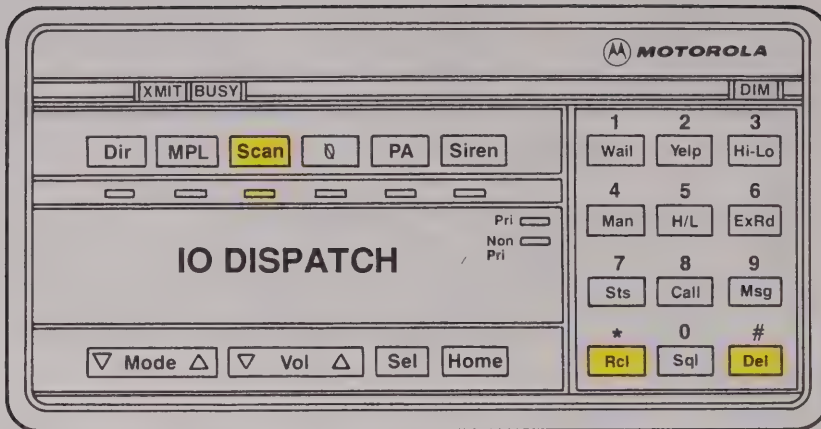
SCAN HANG TIMES

In scan equipped radios, a variable receive hang time is available which determines the time delay from the end of the receive transmission and the start of the scan sequence again. This field programmable value can be useful in ensuring uninterrupted reception of conversations. In addition, a separate variable time delay is used with a transmit hang time. The transmit hang time is the time delay after release of PTT, before the scan sequence begins again. Scan Hang Times are used in the programming of Talk Back Scan.

SCAN ENABLE

This is a field programmable feature that allows the customer to decide in which modes to have Operator Select Scan enabled or disabled. What this does essentially is allow the radio to have a combination of Mode Select Channel Scan monitoring and Operator Select Channel Scan monitoring.

The customer can decide which modes are restricted from mobile operator modification.



SCAN SQUELCH

Through field programming by mode, when **[Scan]** is pressed, all the PL/DPL channels in that scan list will become carrier squelched. The radio is shipped from the factory to sample for coded squelch.

NUISANCE MODE DELETE

A non-priority mode in the scan list that becomes too active, or for other reasons is no longer desirable to scan, may be temporarily deleted by pressing the **[Del]** button while the mode is active. The mode that was temporarily deleted can be restored again by one of four events, pressing the **[Rcl]** button, if scan is turned off and on again, the radio is turned off and on again, or the operator changes selected modes.

Multiple nuisance channel deletes are not permitted. If an attempt to delete a second channel is made, the previously deleted channel will return to the list.

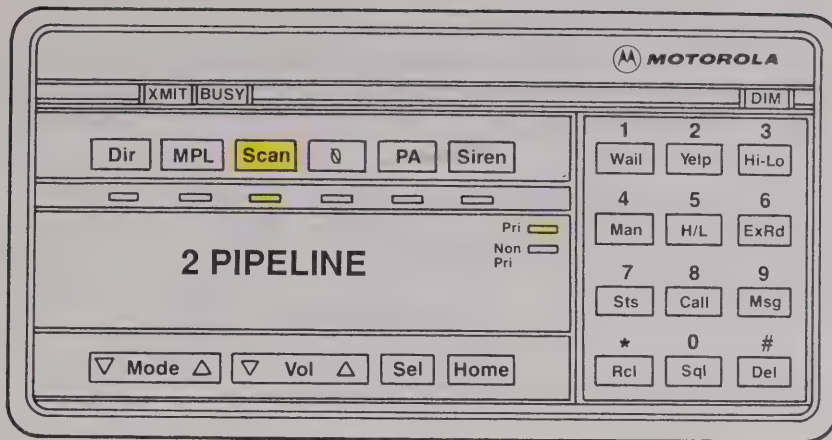
This feature can be enabled or disabled through field programming and is shipped from the factory enabled.

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OPTIONS



MODE SELECT "CHANNEL SCAN" MONITOR (W495)

This option replaces the Operator Select Scan with a mode slaved preprogrammed scan list that cannot be permanently altered or directly reviewed by the operator in any manner other than to perform a temporary delete of a "Nuisance" channel.

Fleet discipline is enhanced by predetermining the modes each operator will be able to scan.

The size of the scan list is limited only to the number of channels programmed in the radio. Consideration should be given to the size of the scan list because the larger the list, the slower the effective rate of scan becomes for non-priority channel sampling.

Mode Select Channel Scan is also made possible through field programming.

* OPERATING INSTRUCTIONS [Scan]

Scan can be turned on and off by pressing the [Scan] button. When scan is on, the red indicator will be lit and the internal scan list for the selected mode is enabled.

When scan activity exists, the currently active mode is displayed and the appropriate priority or non-priority indicator will light. If no activity exists, the display indicates the selected mode until activity on a scanned mode occurs.

When programming, the currently selected mode should be included in the scan list. It is not inserted automatically.

TWO-LEVEL PRIORITY (W421)

Two-Level Priority is a standard feature through field programming. Order (W421) only if Plant Programming (W844) is ordered. See page 12 of this section for a detailed description.

TALK-BACK "CHANNEL SCAN" MONITOR (W703)

Talk-Back Channel Scan monitoring is a standard feature through field programming. Order (W703) only if Plant Programming (W844) is ordered. See page 13 of this section for a detailed description.

OMIT "CHANNEL SCAN" MONITOR (W929)

For those users who do not want Channel Scan operation, this option removes the **[Scan]** button from the Control Unit.

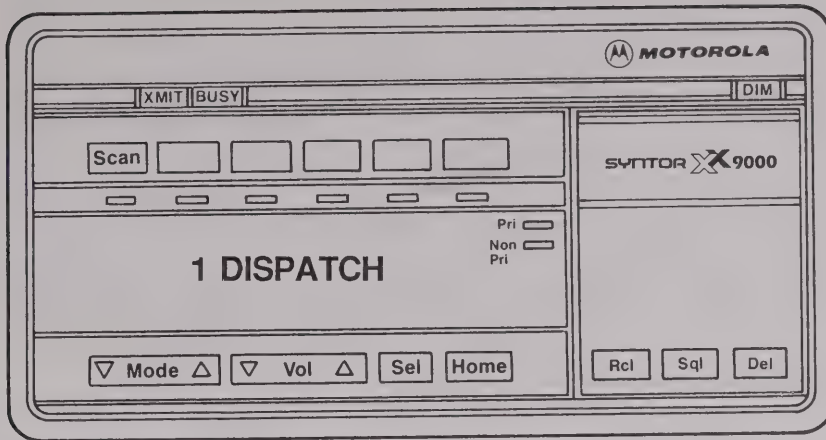
Removing the **[Scan]** button eliminates any confusion among the operators who are not using the feature.

Field retrofit is made possible by ordering the button through NPD (National Parts Department) and field programming.

PLANT PROGRAMMING (W844)

This provides factory programming of the following Mode Select Characteristics; frequencies, PL and DPL codes, repeater talk around, Operator Select Multiple Coded Squelch, Mode Select Channel Scan, Two Level Priority, Talk-Back Channel Scan, AND opening squelch and Time-out Timer.

Features that can not be programmed at the factory include mode names and the unit ID number for any of the MDC-600 Signalling or Mobile Voice Storage options, Horn & Light timers, etc..



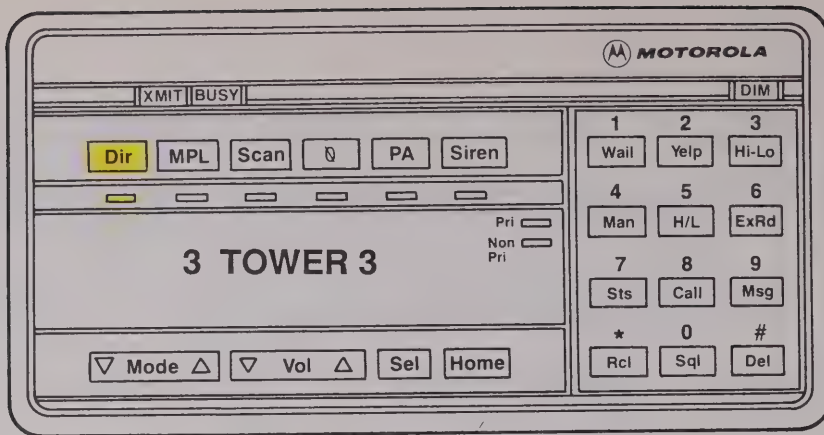
LIMITED CONTROL HEAD FUNCTIONS (W988)

This option was created for those customers that do not initially require a full function Control Unit but would like the ability to expand on options and features at a later time. It basically eliminates the buttons for direct keypad entry.

When W988 is ordered, the unit comes equipped with 16 mode capability, PL and DPL coded squelch and Operator Select Scan. Multiple PL **[MPL]** and Talk Around **[Dir]** buttons are shipped separately with the unit for field installation.

If even further simplification is desired, replace the **[Scan]**, **[Sel]**, **[Rcl]**, and **[Del]** buttons with plugs for a truly basic Control Unit that still features 11-character alphanumeric display, 16 modes and survives MIL STD 810D.

A limited number of options are available with W988 and are clearly marked in the price pages. An additional 16 modes is capable through field programming. Full field expansion is made possible by ordering retrofit kits from Section 1.1 of the price book.



REPEATER TALK AROUND (W425)

This option provides repeater talk-around capability. It directs the mobile to change to an alternate transmit frequency for direct mobile-to-mobile and mobile-to-portable communications.

To activate, press the **[Dir]** button. An indicator below the button will light. Press the microphone PTT and talk. Pressing the button again deactivates talk around and returns the radio to the repeater frequency.

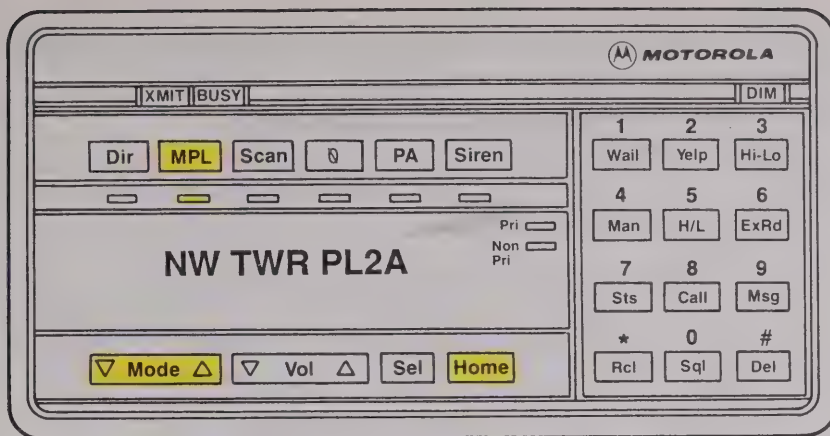
If not otherwise specified the alternate transmit frequency for a mode will be the same as the receive frequency for that mode. This alternate frequency utilizes the transmit Private-Line Code which could be a concern in applications where transmit PL codes and receive PL are different. Alternate PL/DPL codes are not allowed for talk-around programming.

This option can be added in the field by ordering the **[Dir]** button through NPD and field programming the frequency.

64 MODE OPERATION (W930)

This option expands the memory of the control unit and radio to provide up to 64 modes and their associated names.

Large systems that require this many modes will be much less confusing to the mobile operators due to the advantages of displaying a meaningful name for each mode.



OPERATOR SELECT MULTIPLE CODED SQUELCH (W290)

This option adds the **[MPL]** button which enables the operator to override the mode slaved coded squelch. Up to 16 selections are allowed and may be field programmed to provide a user definable name for each.

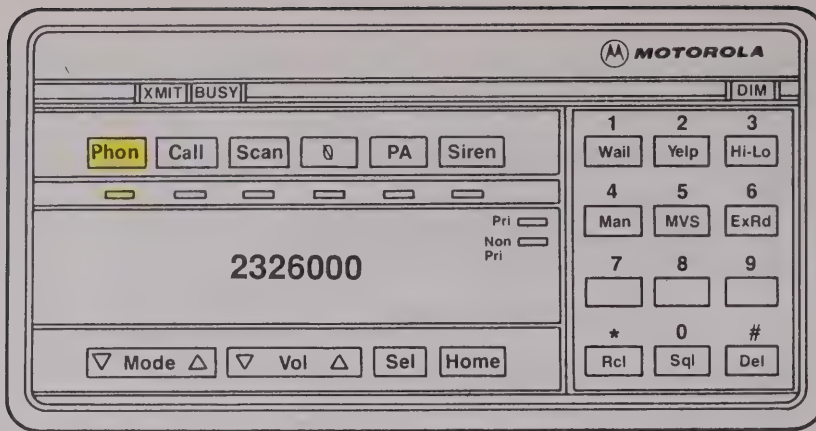
Repeater access, selective call and other system uses are enhanced by allowing one radio to operate on many combinations of operator-selected Private-Line, Digital Private-Line and carrier squelched systems.

Through field programming this option can be restricted by mode to operate on transmit only, receive only, or be disabled.

* OPERATING INSTRUCTIONS

Press **[MPL]**, a visual indicator will light and the last selection will be activated and momentarily displayed.

To select another squelch scheme, hold the **[MPL]** down. A beep will be heard and a light will begin to flash. The radio is now in a "configuration state". To find the selection, use the **[Mode]** rocker to scroll or keypad for direct entry. Press **[Home]** to enter the selection and return to normal operation.



DTMF / TELEPHONE INTERCONNECT (W946)

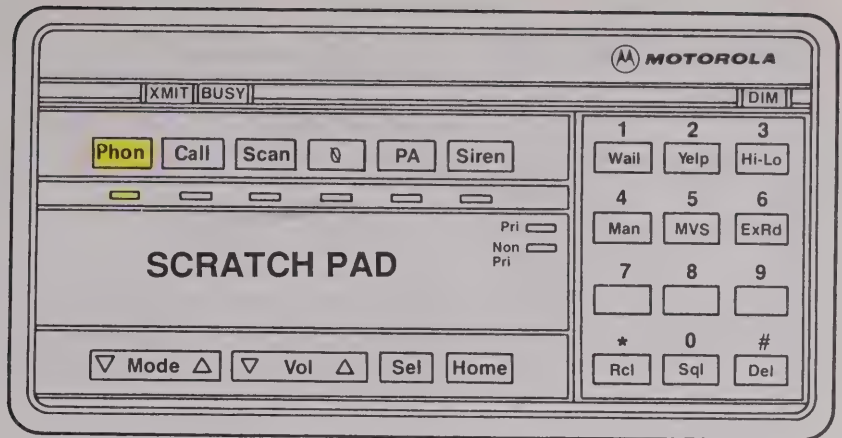
The Dual Tone, Multiple Frequency (DTMF) Telephone Interface option adds DTMF Selective Call and Telephone Interconnect to the radio. The features included are:

- * 9 memories for 16-digit numbers
- * Redial memory
- * 9 memories for 4-digit unit ID number
- * 5-digit auto-connect code
- * 5-digit auto-disconnect code
- * 4-digit unit decode capability
- * 2-digit group decode capability
- * Dialing sequence pause
- * Keypad lockout
- * Alarms option with Horn and Lights Call Alert
- * Field programmable names for a 9 phone number list and a 9 unit number list

Capabilities of the DTMF option include; storing phone numbers, dialing numbers from memory, redialing a number, making unit calls and group calls. The **[Phon]** button on the Control Unit activates the Telephone interface. The **[CALL]** button on the Control Unit activates the DTMF Call features of the option.

The radio will ship with one button installed and the other separate in the box. The radio can have both buttons if the customer is using DTMF and telephone interconnect.

continued next page



* TELEPHONE INTERCONNECT

The DTMF/Telephone Interconnect option adds full telephone interconnect operation when used with a properly equipped base station. The option can handle autopatch access and de-access codes of up to five digits each.

There are two levels of telephone calling capability, memory and unlimited. The field programmer selects one of these levels when prompted to choose either "YES" or "NO" for KEYPAD ENABLED.

The memory level restricts the operator from keypad entry of telephone numbers. Through field programming, the operator is limited to a stored list of nine phone numbers. This list may not be modified by the mobile operator.

The unlimited level includes the stored list of nine numbers and allows keypad entry of any other phone number. The unlimited level also allows the operator to change the stored phone list using direct keypad entry.

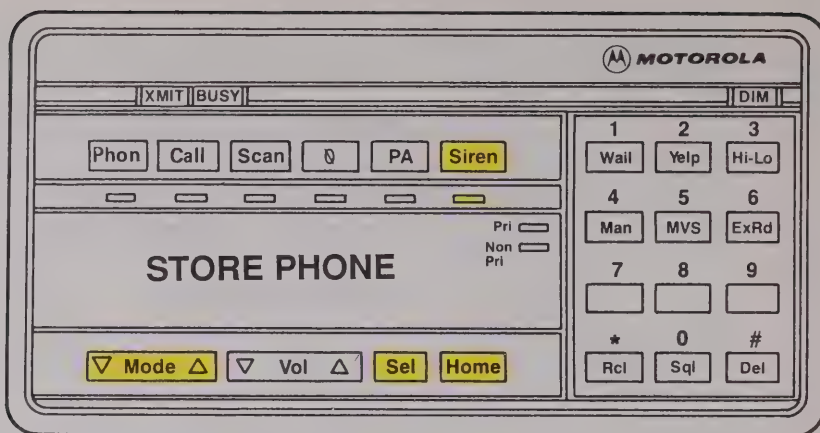
The phone list consists of up to nine 16-digit phone numbers plus the last number dialed. The non-volatile memory on the option card stores the phone list.

* OPERATING INSTRUCTIONS

Storing Phone Numbers In Memory

Press the **[Phon]** button. An alert tone (beep) is heard and the indicator below the button blinks, indicating the Phone option is on. The display now acts as a "scratch pad" for entering phone numbers using the Control Unit's keypad, unless KEYPAD ENABLED is programmed "NO".

continued(W946)



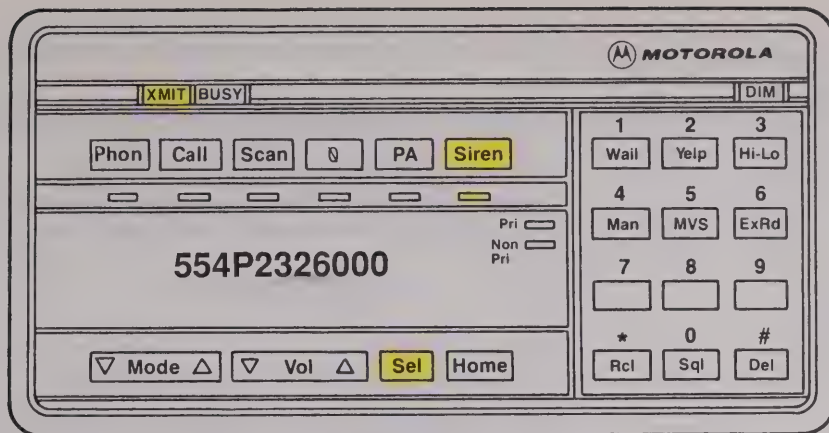
Use the **[Mode]** rocker to scroll to "STORE PHONE", Then press the **[Sel]** button. The display changes to "PHONE 1". The generic "PHONE 1" display can be replaced with a user identifiable name through field programming. To store a phone number in one of the nine memory locations, use the mode button to scroll to the name of that location. If the phone number is left on the display for more that 1.5 seconds, the display changes to the phone number stored in that location, then it switches back to the name. Left alone, the display alternates between name and number every 1.5 seconds. This allows reviewing a phone number before changing or dialing the number.

When the desired memory location is displayed, use the keypad to enter the number to be stored. The new number may be entered in only when the name for the location displays. Keypad entries cannot be made while numbers are displayed.

Press the **[Sel]** or the **[Home]** button for the option to store the phone number. Pressing **[Sel]** stores the number and leaves the option on to continue making changes. Pressing **[Home]** stores the number and turns the option off. If the operator does not want the phone number to replace the number at the location selected first, press the **[Mode]** rocker once. This cancels the digits entered and does not change the memory for that location.

In the Phone mode, a "C" precedes the first digit. The "C" indicates the Auto-Connect code is sent before the phone number. Delete the "C" if a secondary Phone Patch is desired instead of the programmed Auto-Connect. Erase individual digits by using the special key sequence. (see next page)

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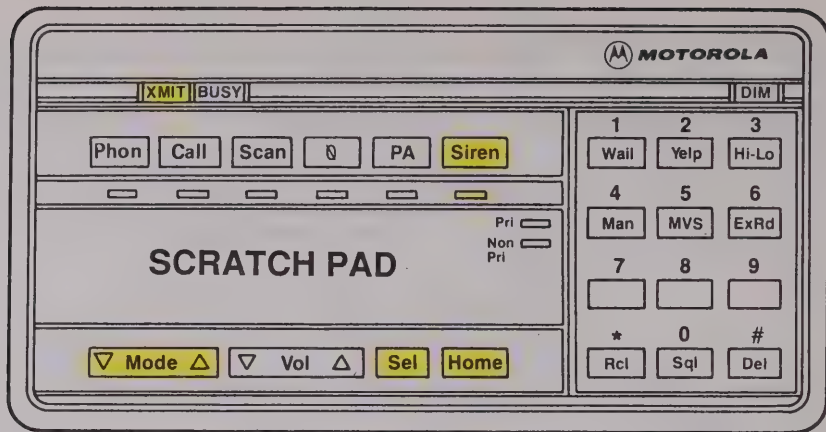
Special key sequences help program features of the Telephone Interconnect option. Auto-Connect and Pause are such features.

Special Key Sequences:

- * Press * displays "***"; the single digit "*" will be dialed.
- * Press # displays "#"; the single digit "#" will be dialed.
- * Press * # displays "P" to de-key radio in the middle of a number; used to allow the channel to be monitored. Press **[Sel]** to dial the remainder of the number.
- * Press # # erases the previous character.

The Auto-Connect feature is a programmable code stored in the radio's EEPROM. The code gains access to the primary telephone patch then dekeys the radio. Press the **[Sel]** button to continue dialing.

The Pause feature stops dialing and dekeys the radio. Press the **[Sel]** button to send the remainder of the number. Two possible uses for this pause delay is to allow secondary phone patch access/deaccess codes to be stored as part of the number in memory or credit card calling.



Dialing From Memory

Pressing the **[Phon]** button on the Control Unit activates the option and changes the display to "SCRATCH PAD". Use the **[Mode]** rocker to scroll to the number/name desired. Press the **[Sel]** button and the radio keys, beginning the dialing sequence. If the first character of the number dialed is a "C" (connect), the radio sends the Auto-Connect code, then dekeys the radio.

Monitor the channel to determine if the connect code successfully activated the phone patch. Press the **[Sel]** button to continue dialing. Should any characters in the number be a "P" (pause), the radio dekeys until the **[Sel]** button is depressed again, sending the remainder of the number. If the auto-access code was included in the number dialed, turning the option off, ie: pressing the **[Home]** button, will key the radio and the option will send the auto-deaccess code.

Dialing From Scratch Pad

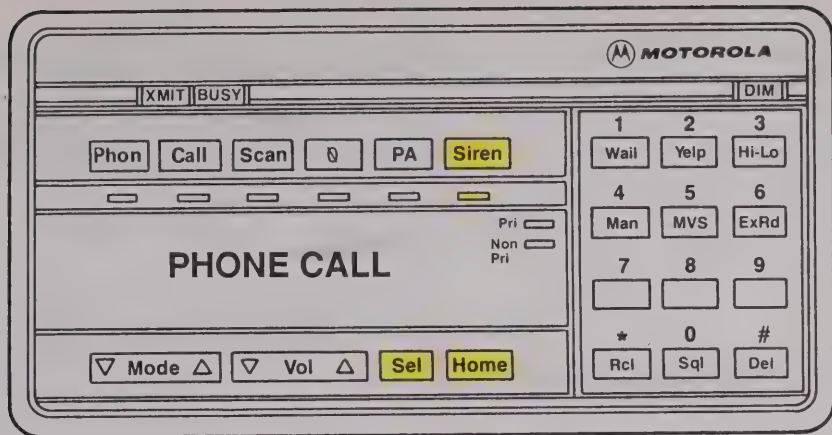
Press the **[Phon]** button. The display changes to the scratch pad. While "SCRATCH PAD" appears on the display, the operator enters the desired phone number from the keypad, (if Keypad Enable is programmed ON). The number may then be dialed by pressing the **[Sel]** button.

Redialing A Number

After the radio transmits a number, the option stores the number in a scratch pad memory. This scratch pad memory (redial memory) retains the last number dialed until another number is keyed in from the keypad or dialed from memory.

Press the **[Phon]** button. The display changes to the scratch pad. Next press the **[Sel]** button to redial the number. The sequence of dialing the number is the same as described in 'Dialing From Memory'.

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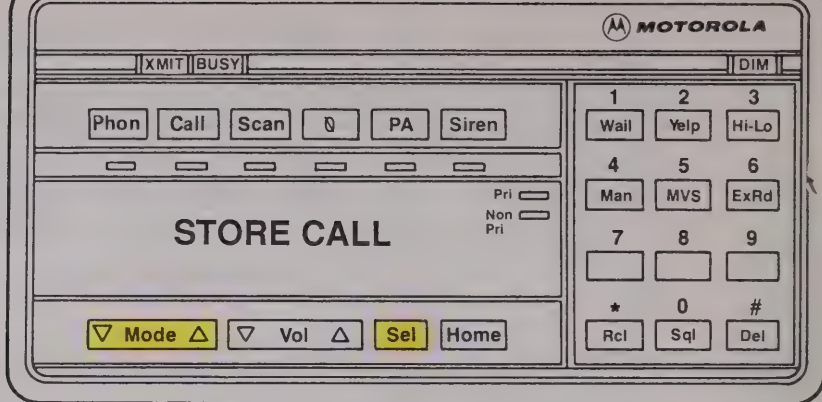
Press the **[Home]** button to turn off the option. The Auto-Disconnect code transmits if the redial number used the Auto-Connect feature. The **[Phon]** indicator stops blinking and the radio returns to normal operation.

Receiving a Phone Call

When a landline party wants to initiate a call from a properly equipped base station, the caller dials the interconnect terminal phone number. If the system is busy, the caller hears a normal busy signal and has to redial the number. If the phone line is available, the caller hears a tone. The caller then enters the access code (ID number) of the individual to whom he wishes to talk. Both landline party and the mobile operator will hear a ringing tone. The particular phone patch used may or may not allow the landline caller to hear the ringing tone.

To answer a call, the mobile operator presses the **[Phon]** button. An alert tone (beep) will be heard and the display will show "PHONE CALL". The mobile operator then presses the **[Sel]** button to send the phone patch auto-access code to turn the phone patch on.

When the phone conversation is over, press the **[Home]** button to send the auto-deaccess code and return to normal operation.



* DTMF Encode/Decode

The DTMF/Telephone Interconnect option encodes and decodes DTMF tones for various signalling needs. From an operational stand point, this is very similar to **TELEPHONE INTERCONNECT** operation. There are two levels of selective call capability, unlimited and restricted. The field programmer selects one of these levels when prompted to choose either "YES" or "NO" for KEYPAD ENABLED.

The unlimited level allows direct keypad entry of destination ID numbers in addition to an ID memory capability. The ID memory list consists of nine 4-digit ID numbers plus the last call placed or received. The non-volatile memory on the option card stores the memory list. The list can be changed by using the keypad. If desired, the keypad entry capability may be restricted by the field programmer. DTMF provides no acknowledge.

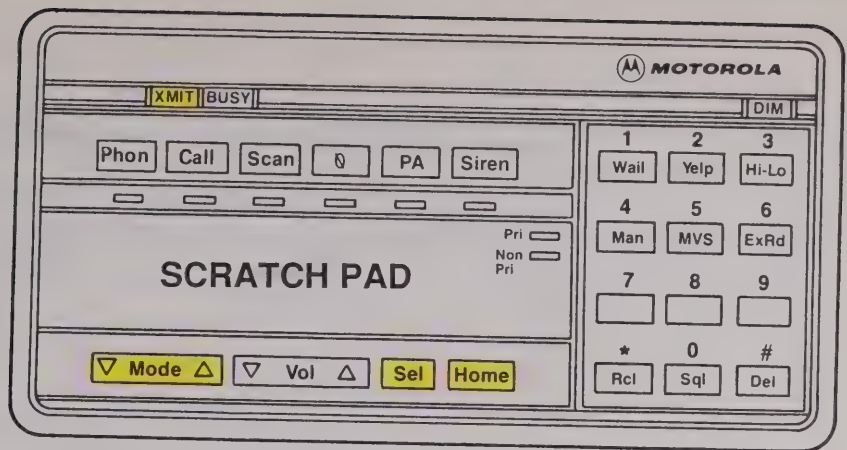
The restricted level prohibits the operator from keypad entry of destination ID numbers. Through field programming the operator is limited to a stored list of nine 4-digit ID numbers. This list may not be modified by the mobile operator.

* OPERATING INSTRUCTIONS

Storing Call Numbers In Memory

Press the **[CALL]** button. An alert tone (beep) is heard and the indicator below the button blinks, indicating the DTMF option is on. The display now acts as a "scratch pad" for entering unit numbers using the Control Unit's keypad, unless KEYPAD ENABLED is programmed "NO".

Use the **[Mode]** rocker to scroll to "STORE CALL", then press the **[Sel]** button. The display changes to "UNIT 1". Through field programming, the generic "UNIT 1" display can be replaced with a user identifiable name. To store a unit number in one of the nine memory locations, use the **[Mode]** button to scroll to the name of that location. If the unit name is left on the display for more than 1.5 seconds, the display changes to the unit number stored in that location, then it switches back to the name.



Left alone, the display alternates between name and number every 1.5 seconds. This allows reviewing a unit number before changing or sending the number. When the desired memory location is displayed, use the keypad to enter the number to be stored. The new number may be entered only when the name for the location displays. Keypad entries cannot be made while numbers are displayed.

Pressing the **[Sel]** or the **[Home]** button will store the unit number. Pressing **[Sel]** stores the number and leaves the option on to continue making changes. Pressing **[Home]** stores the number and turns the option off. If the operator does not want the unit number to replace the number at the location selected first, press the **[Mode]** rocker once. This cancels the digits entered and does not change the memory for that location.

Selecting From Memory

Pressing the **[CALL]** button on the Control Unit activates the option and changes the display to "SCRATCH PAD". Use the **[Mode]** rocker to scroll to the name/number desired. Press the **[Sel]** select button and the radio transmits.

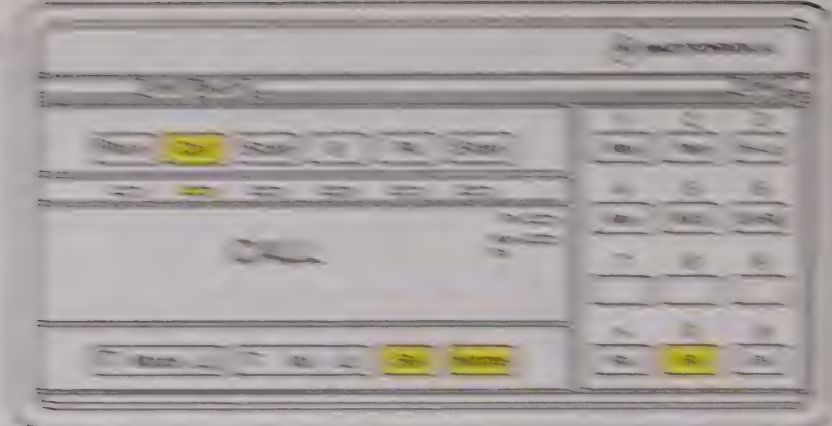
Pressing **[Home]** deactivates the option and the indicator goes off.

Redialing A Number

After the radio transmits a number, the option stores the number in its scratch pad memory. This scratch pad memory (redial memory) retains the last unit number sent until another number is entered from the keypad.

Press the **[CALL]** button. The display changes to the scratch pad unit name/number. Press **[Sel]** to send the unit number. Press **[Home]** to deactivate the option.

continued next page



Using the Calculator

The calculator is a powerful tool that can be used to perform a wide range of calculations. It is a portable device that can be used anywhere, anytime. The calculator is a valuable tool for anyone who needs to perform calculations frequently.

Entering a Number

To enter a number, simply press the corresponding number key. For example, to enter the number 123, press the 1 key, then the 2 key, then the 3 key. The number will appear on the display. If you want to enter a decimal number, press the decimal point key after the number.

If the number is negative, press the negative sign key before the number. For example, to enter -123, press the negative sign key, then the 1 key, then the 2 key, then the 3 key. The negative sign will appear on the display. If you want to enter a fraction, press the fraction key before the numerator, then the denominator, then the equals key.

The calculator also has a memory function. You can store a number in memory and recall it later. To store a number, press the memory store key (M+) after the number. To recall the number, press the memory recall key (MR).

Press the equals key to perform the calculation. The result will appear on the display. The calculator also has a power-off key (OFF) to turn the calculator off. Press the power-off key when you are finished using the calculator.

If the calculator is not working properly, check the battery level. If the battery is low, replace the battery. If the calculator is still not working, contact the manufacturer for assistance.

Entering a Formula

When the calculator is in formula mode, you can enter a formula and the calculator will perform the calculation. To enter a formula, press the formula key (F), then the number keys, then the operation keys, then the equals key. For example, to enter the formula $1 + 2 \times 3$, press the formula key, then the 1 key, then the plus key, then the 2 key, then the multiply key, then the 3 key, then the equals key. The result, 7, will appear on the display.

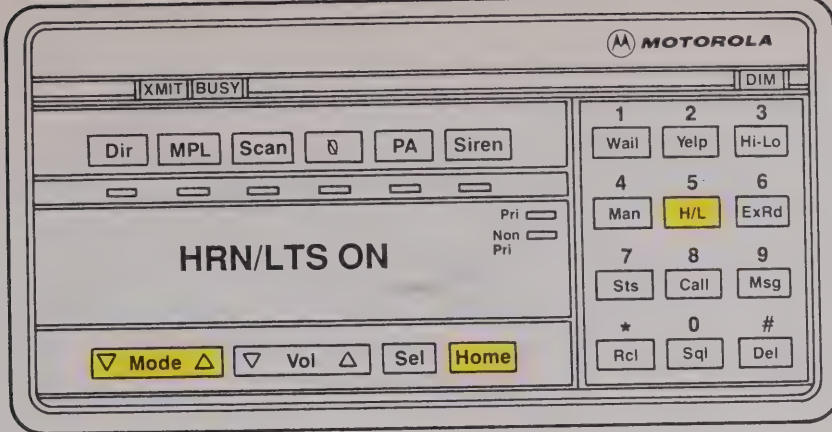
Control Unit Parameters

The parameters for the Control Unit are:

- * Button Placement for Phone and DTMF Call - customer selected to any of the 6 indicator buttons.
- * Phone Number Names - 9 names, a maximum of 11 characters each, to replace the generic, "Phone 1," names in the phone memory list.
- * DTMF Call Names - 9 names, a maximum of 11 characters each, to replace the generic, "Unit 1", names in the unit memory list.
- * Vehicle Interface Ports (VIP) Outputs - only systems equipped with the Alarms option have this requirement to select the Lights relay output and Horn relay output.
- * Horn and Light Button - customer selected to any of the 9 upper keypad locations (1 - 9).

When (W946) is ordered, the radio ships from the factory with the following default settings:

* Decoder Muting Type	NO Muting
* Group	N/A
* Unit ID	5555
* System Delay	950 mS
* Digit / Interdigit Time	120 mS
* Mode Slaved DTMF Unit Call	NO
* Mode Slaved Telephone	NO
* Auto Connect Code	*
* Auto Disconnect Code	#
* Keypad Enabled	YES
* Horn and Lights	OFF



EXTERNAL ALARM (W116)

This option is required when horn and lights alarm activation is needed for incoming telephone and DTMF selective calls. Selective Call Encode/Decode (W681) will include this External Alarm feature. Duration of these alarms is field programmable.

The operator can select the type of alert desired before leaving the vehicle. The choices appear in plain English on the Control Unit's display making the selection quick and easy. It's the perfect solution for people that are frequently away from their vehicles.

* OPERATING INSTRUCTIONS

Pressing the **[H/L]** button will momentarily display the current External Alarm setting, "HORN ON", "LIGHTS ON", "HRN/LTS ON ", or "HRN/LTS OFF".

To change the External Alarm setting, the **[H/L]** button is held down until a beep is heard and the current alarm selection shows on the display. The operator can then use the **[Mode]** rocker to scroll through the four choices. Once the desired Alarm is displayed, pressing the **[Home]** button will return to normal operations with the Alarm option set to the desired configuration..

The setting has a volatile memory, so turning the radio off and on will result in a "Horn and Lights Off" condition.

NOTE: If MDC-600 (W681) is in the system and Sel Call Decode is enabled, the Horn and Lights button may be reprogrammed as an indicator button.

"MDC-600" SIGNALLING BASIC DESCRIPTION

MDC-600 signalling is a microprocessor based, general purpose, data control and information system specifically designed for land mobile operations. It identifies transmitters automatically, can incorporate selective calling, and can also send status/message data. A typical system consists of a console unit connected to a base station, and one or more mobile units.

The signalling system uses Phase Shift Keying (PSK) modulation and demodulation at 600 bps on a 1500-Hz carrier. Data transfers in bursts or packets approximately 300 milliseconds long. The sensitivity of the system is better than or equal to the sensitivity required for the reception of intelligible voice. Special coding techniques detect and correct errors so falsing rates are extremely low.

The mobile unit is a single Systems 9000 option circuit board consisting of a HD637B01V0P microcomputer, an external 8k ROM, PSK filtering, and a 20-pin connector. This option is housed internally in the radio and is connected to the radio by a short ribbon cable. The microprocessors performs all the PSK modulation, demodulation, encoding, and decoding in the MDC-600 signalling system. It also performs all the serial bus functions that enable it to communicate with the radio and all the other options that make up the rest of the system.

The system can address up to 9,999 unique unit identification codes - 10 fleet codes with 100 groups per fleet in a shared system. Each mobile unit is programmed with a unique unit number, group number, and fleet number. These numbers are used to identify and address the mobile units. All data packets contain the unit number or a combination of group or fleet numbers.

MDC-600 signalling units have a special detection algorithm to mute the audio during any data reception. This feature, known as Data Operated Squelch, makes the reception of data nearly transparent to listeners with MDC-600 signalling. The typical DOS detect time is 50ms. Acknowledgment and retransmission logic makes the basic function reliable and automatic. The receiving unit automatically acknowledges certain commands issued from the mobile or base unit. The sending unit automatically retransmits if it does not receive an acknowledgment.

PROGRAMMING THE SYSTEM

Many of the features or configurations of the system are selected by programming an Electrically Erasable PROM (EEPROM) located in the radio. Some system functions come programmed by the factory. An optional EEPROM programmer is used to program mobile unit ID codes (unit, group, and fleet numbers), system access delays, alarm duration, and Select Call Muting modes.

The following is a list of programmable MDC-600 Full Feature Options:

- * UNIT ID NUMBER
- * GROUP ID NUMBER
- * FLEET ID NUMBER
- * SYSTEM ACCESS DELAY
- * PTT ID/EMERGENCY ENABLE
- * PTT ID AT BEGINNING
- * PTT ID AT END
- * SIDE TONE ENABLE
- * SILENT EMERGENCY
- * EMERGENCY DATA CHANNEL
ENABLE
- * EMERGENCY DATA CHANNEL
- * STATUS ENABLE
- * NUMBER OF STATUSES
- * MESSAGE ENABLE
- * NUMBER OF MESSAGES
- * STATUS/MESSAGE DATA CHANNEL
ENABLE
- * STATUS/MESSAGE DATA CHANNEL
- * DISPATCHER ROUTING ENABLE
- * ENCODE ENABLE
- * DECODE ENABLE
- * MUTING SELECTION
- * UNIT ENCODE ENABLE
- * DECODE DISPLAY ENABLE
- * NUMBER OF UNIT NAMES
- * HORN DURATION
- * LIGHTS DURATION
- * MODE STRAP ENABLE

Definitions:

Unit IDs can be up to 4 digits, Group IDs up to 2 digits, and Fleet IDs 1 digit. The factory programs the default value for Unit IDs to be 5555. The number of unit names that may be programmed into the "Systems 9000" Control Unit is 0 to 63. System Access Delay time is preprogrammed at 500 milliseconds. Sidetone Enable will enable the audio sidetone during transmission of the PTT ID data packet at the start of transmission. Emergency Data Channel Enable allows emergency transmissions to go out on a determined frequency channel. Horn Duration is from 5 to 75 seconds in 5-second intervals with optional infinite duration. Lights Duration is from 15 to 225 seconds in 15-second intervals with optional infinite duration. Mode Strap Enable allows enabling or disabling PTT ID and Selective Call Encoding on a mode-by-mode basis.

"MDC-600" UNIT ID AND EMERGENCY ALERT (W452)

Every time the push-to-talk switch is activated on a mobile, its unit ID number is automatically displayed at the console. The dispatcher immediately knows who's on the air, eliminating the need for voice ID transmissions. Since all transmissions are "signed", the dispatcher can identify any operator who is using the system for non-business purposes.

The Emergency Alert feature of this option allows an operator to send an emergency message that flashes that unit's ID number and sounds an alarm to the dispatcher.

Emergency operation in the mobile can be programmed to be either silent or audible. If the radio is equipped with Silent Emergency, the receive audio will be muted and there will be no indication in the vehicle (no lights or audio including dispatch) that an Emergency signal has been sent. The radio will remain in this condition until the operator pushes PTT. This feature enhances operator safety during a life threatening event.

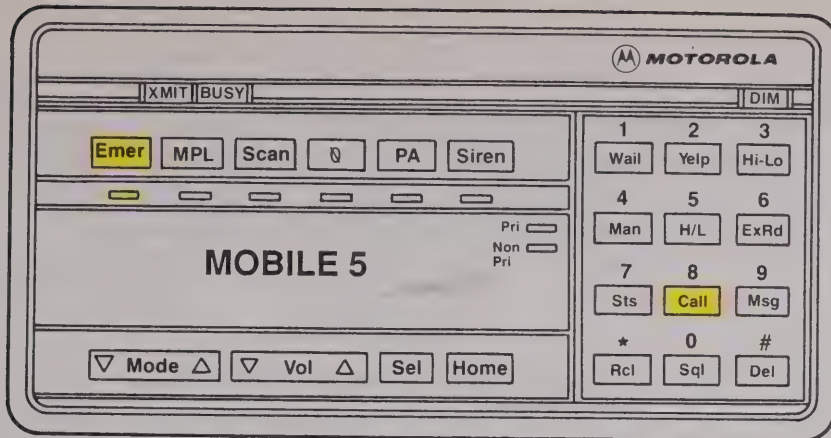
Emergency Alert transmissions have absolute priority over any other radio function in progress. Keying the microphone only temporarily suspends it. The mobile can send the Alert up to 20 times, and after base acknowledgment it ceases.

All MDC-600 transmissions can be printed at the fixed end to provide hard copy documentation of all radio traffic. Every transmission print out includes the time and date of each transmission and the ID of the message originator. When a trailing ID is also programmed into this option, the duration of each transmission can also be determined.

*** OPERATING INSTRUCTIONS**

Every time the operator pushes the microphone PTT the unit identification number for that vehicle is automatically sent.

The Emergency Alert feature can be activated by pressing the **[Emer]** button on the Control Unit. Optional devices to activate the Emergency Alert include the Hidden Push-button (W688)✓ and Hidden Footswitch (W470) which require programming of one of the Vehicle Interface Ports (VIP) on the "Systems 9000" Control Unit.



"MDC-600" SELECTIVE CALL ENCODE/DECODE (W681)

This option includes all the features of Unit ID and Emergency plus the ability for the dispatcher to selectively call an individual unit, a group of units, or the entire fleet. In addition, a mobile can selectively call another properly equipped mobile. The voice transmissions include a data packet that causes the receiving units to unmute. During a unit-to-unit selective call, the name of the caller, if programmed in the Control Unit, or the caller's unit ID number appears on the receiving unit's display for as long as the caller keys the microphone switch. This option does not allow mobile-to-mobile paging.

The ability for one mobile to selectively call another mobile is further enhanced with the ability to store up to nine frequently called units in the control unit's memory. The operator can use the keypad to enter a specific unit's ID number or scroll through the prestored Names and their associated numbers to select the desired unit.

Note: This option is not compatible on SECURENET enabled modes.

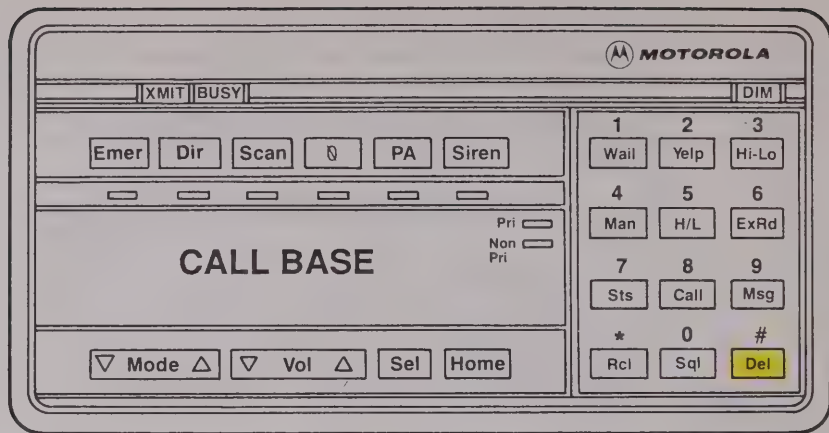
* OPERATING INSTRUCTIONS

Selective Call Decode (Sel Call Decode)

The base operator may select various calling commands when transmitting, if all of the mobiles have AND (or in special cases OR and DATA) muting and Selective Call Decode. These include Auto Sel Call, Call with Acknowledge, and Page with Acknowledge.

AUTO SEL CALL

The Auto Sel Call is a console function. The base operator enters the unit, group, or fleet ID number and uses the microphone as usual. The selected unit, group, or fleet radios unmute for the duration of the message then automatically remute. There is no acknowledgment with this function, and no other units hear the transmission unless they are monitoring the channel.



CALL WITH ACKNOWLEDGE

When a mobile unit receives a call, the speaker unmutes and sounds a series of beeps for two seconds, the Control Unit displays "CALL BASE" for one second every five seconds, and any external alarms are activated.

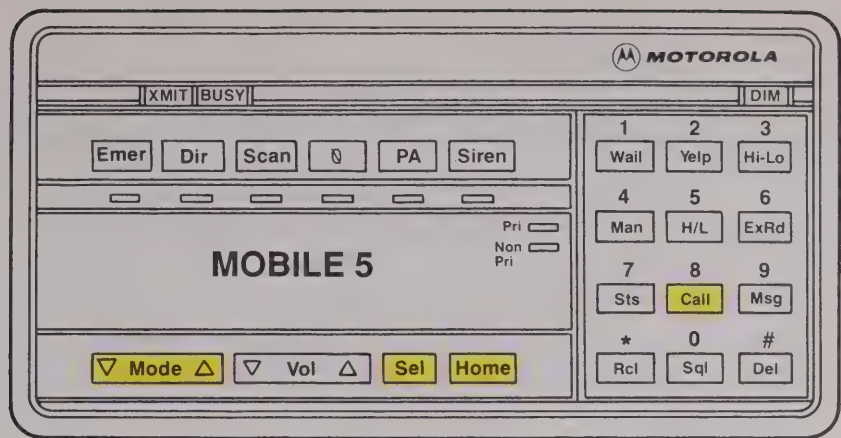
If an individual mobile receives a call, an acknowledge packet is sent to the base automatically. Should the base not receive that acknowledge packet, the base retransmits its call up to four more times, or until an acknowledge is received. These automatic retransmissions are not sent if the call is made to a group or a fleet of units. This function does not remute the audio automatically. The mobile operator must reset the muting manually by pressing the **[Del]** button, coming off-hook, or by transmitting. This also clears the display and disables the external alarms. This function is available only if the Select Call console is used at the base station.

PAGE WITH ACKNOWLEDGE

This function is similar to CALL WITH ACKNOWLEDGE. When a mobile receives a Page, the display shows "CALL BASE," external alarms activate, and a series of short beeps sound for 10 seconds. With this function, no audio unmuting occurs in the mobile units. Upon reception of an individual page, an acknowledge is sent, just as with CALL WITH ACKNOWLEDGE. Press the **[Del]** button or transmit to clear the display and disable the external alarms. Since no muting functions are affected, AND muting need not be selected for paging to operate properly. This PAGE function is a base-initiated feature. A mobile cannot page another mobile.

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Continued (W681)



Selective Calling - Encoding (Sel Call Encode)

An operator of a mobile can selectively call the base, other members of his group, or fleet or a single mobile unit by selecting the appropriate SEL CALL mode. The voice transmissions include a data packet that causes the receiving units to unmute. During a unit-to-unit selective call, the name of the caller, if included in the Receiver's programmed list, appears on the receiving unit's display for as long as the caller keys the microphone switch.

A **[Call]** button is available for mobile units programmed with MDC-600 SEL CALL ENCODE. Pressing this button displays the previous SEL CALL mode (Base, Fleet, Group, or Unit). Hold the **[Call]** button down until a beep sounds. Now select a SEL CALL mode by using the **[Mode]** rocker. Press the **[Home]** button to activate the SEL CALL ENCODE. This directs voice transmissions to the SEL CALL selection.

Optional programming allows unit-to-unit selective calling. To choose a unit-to-unit call, hold **[Call]** until a beep sounds, go to the Unit mode, press **[Sel]** to display the last unit called, then use **[Mode]** to scroll through the preprogrammed unit names. If the unit to be called does not exist in the list of preprogrammed names, use the keypad to enter the unit's number. After making the selection, press the **[Home]** button. Voice transmissions are now directed to the mobile unit selected.

Note: This feature should be disabled on SECURENET modes.

BASE CALLS

All voice transmissions are directed to the base when the BASE mode is selected. The MDC-600 console unit displays the unit ID number as in the PTT ID operation. No mobile units can hear the base transmission unless they select the proper muting mode or if they monitor the channel.

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GROUP CALLS

Selection of GROUP allows voice transmissions to be heard only by members of the selected group and the base unit. Other mobile units belonging to different groups in the system do not hear the transmissions unless they are monitoring the channel. The base unit displays the GROUP ID number during a SEL CALL ENCODE GROUP call.

FLEET CALLS

When FLEET is selected, all voice transmissions from the unit are heard by members of the same fleet and by the base unit. The base unit displays the FLEET ID number during a SEL CALL ENCODE FLEET call.

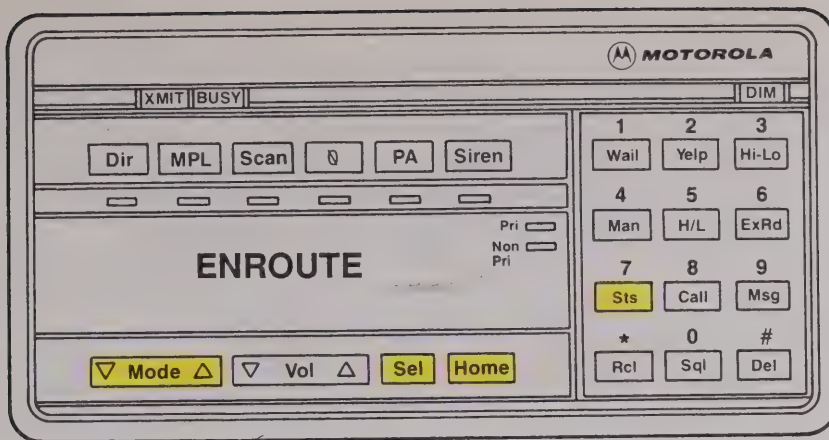
UNIT-TO-UNIT CALLS

The calling mobile unit selects another unit to receive all voice transmissions with the UNIT mode. Other members of the same group or fleet do not hear the voice transmissions unless they are monitoring the channel. The base unit hears the voice transmission and displays the unit ID of the two mobile units engaged in the select call. The base displays the calling unit's ID number followed by the receiving unit's ID number.

The unit ID of the caller appears on the display of the receiving unit. If the receive unit number matches one of the names preprogrammed into the Control Unit, the name of the caller displays instead of the unit ID number. The name of the caller displays in the receiving unit as long as the caller keys the microphone.

To clear the operator's display if the calling unit's ID/name remains on the display after the completion of the call, press **[Del]**, or press the PTT.

The receiving unit's return transmission is automatically routed to the caller only if the receiving unit is in the UNIT mode. This is known as AUTO TALKAROUND. The receiving unit's name or ID number displays on the calling unit's Control Unit as long as the microphone is keyed.



"MDC-600" STATUS (W824)

The Status option also includes all the features of the unit ID and Emergency Alert in addition to the ability to send up to eight (8) predefined Status conditions.

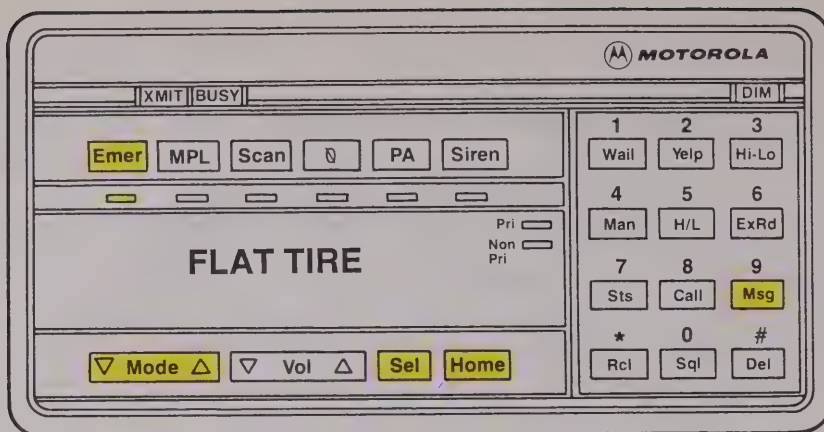
A Status such as "ENROUTE" or "OUT OF SERVICE" can be quickly sent to the dispatcher without using valuable air time. A code can be assigned a name or function for conditions selected. Assignment is made by programming the Control Unit. A status **[Sts]** button on the keypad activates this feature.

* OPERATING INSTRUCTIONS

Hold the **[Sts]** button until a beep sounds. Use the **[Mode]** rocker to select the preprogrammed code name of the conditions to transmit. To transmit the status selection, press the **[Home]** button. The keypad can be used to select a status. Hold the **[Sts]** button until a beep sounds, enter the number of the desired status code, then press **[Home]**. To view the name of a code selected with the keypad, just press the **[Sel]** button.

The receiving MDC-600 console acknowledges automatically when the mobile radio makes a status transmission. The mobile unit receives this acknowledge by sounding 2 short tones. Should the mobile unit not receive the base's acknowledgment, the unit retransmits the status automatically up to four times or until the acknowledgment is received from the base. If the mobile unit still does not receive the acknowledgment from the base, a low tone sounds and the display shows "NO ACK" for one second every five seconds.

The Status condition may be sent with each PTT/ID transmission through field programming, but will have no acknowledgment by the base station.



"MDC-600" MESSAGE (W825)

This includes all of the features of the (W824) Status option plus the **[Msg]** button which allows an additional eight (8) message conditions to be sent.

* OPERATING INSTRUCTIONS

Hold the **[Msg]** button until a beep sounds. Use the **[Mode]** rocker to select the preprogrammed code name of the conditions to transmit. To transmit the message selection, press the **[Home]** button. The keypad can be used to select a message. Hold the **[Msg]** button until a beep sounds, enter the number of the desired message code, then press **[Home]**. To view the name of a code selected with the keypad, just press the **[Sel]** button.

The receiving MDC-600 console acknowledges automatically when the mobile radio makes a message transmission. The mobile unit receives this acknowledge by sounding 2 short tones. Should the mobile unit not receive the base's acknowledgment, the unit retransmits the message automatically up to four times or until the acknowledgment is received from the base. If the mobile unit still does not receive the acknowledgment from the base, a low tone sounds and the display shows "NO ACK" for one second every five seconds.

Note: The H - series console supports only one message.

EMERGENCY PUSHBUTTON ON CONTROL HEAD (W873)

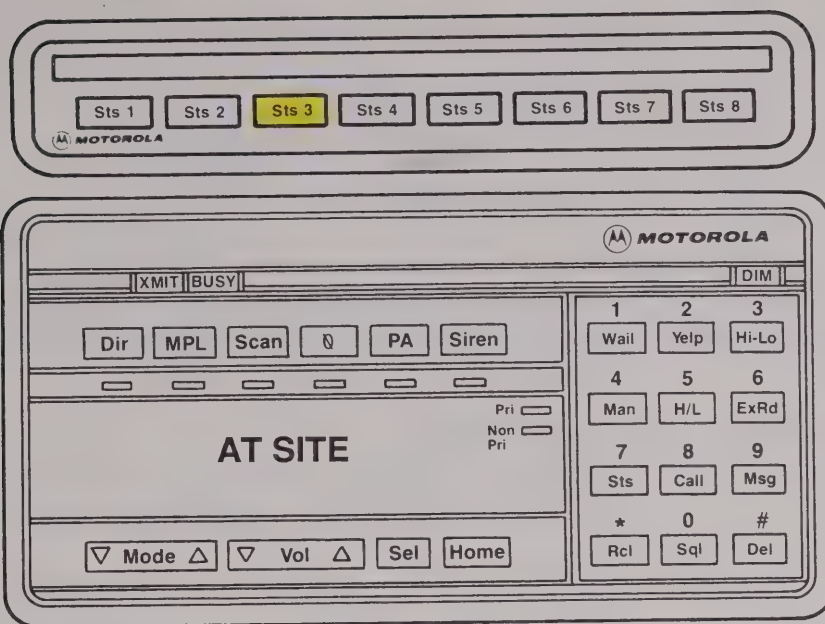
Provides **[Emer]** button For Control Unit.

EMERGENCY HIDDEN PUSHBUTTON (W688)

Provides button external to radio. Requires Vehicle Interface Port (VIP) field programming.

EMERGENCY HIDDEN FOOTSWITCH (W470)

Provides footswitch external to radio. Requires Vehicle Interface Port (VIP) field programming.

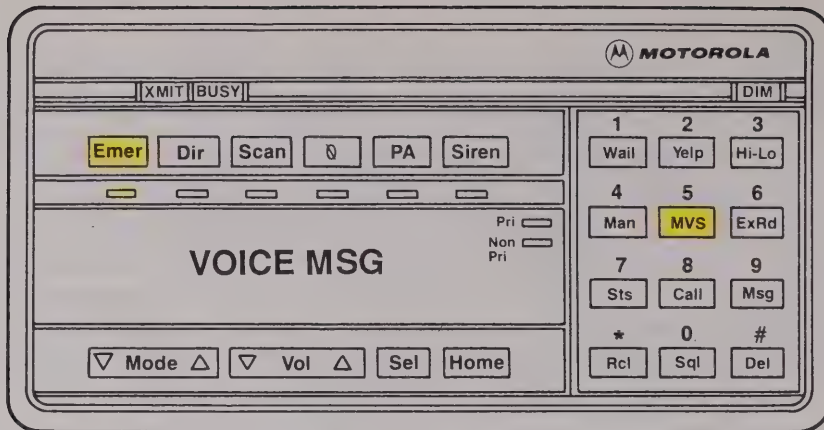


"MDC-600" DIRECT ENTRY STATUS (W983)

"MDC-600" DIRECT ENTRY STATUS/MESSAGE (W984)

These options provides the same features as the MDC-600 Status or Status/Message option but includes dedicated buttons to send the desired signal. The buttons are positioned in an attractive supplemental housing (2 housings if W984 is ordered) that mounts directly above the control unit and uses the same mounting bracket.

Users that don't require the ability to display status or message names may prefer the dedicated button approach which allows one touch activation of a status or message signal.



MOBILE VOICE STORAGE (W712)

Mobile Voice Storage operation allows up to 30 seconds of actual voice to be stored in the Control Unit for later retrieval by either the mobile operator or the dispatcher.

MVS improves the efficiency of a communication system by eliminating the need for time consuming call-backs and repetitious messages. It's the perfect solution for those users that are frequently away from their vehicles.

The mobile operator can review messages immediately upon returning to the vehicle without having to wait for the radio channel to clear. The operator can replay the message as often as necessary to ensure understanding.

When radio traffic is heavy, the mobile operator can record a message for the dispatcher to review, leave the vehicle and have a reply waiting when they return.

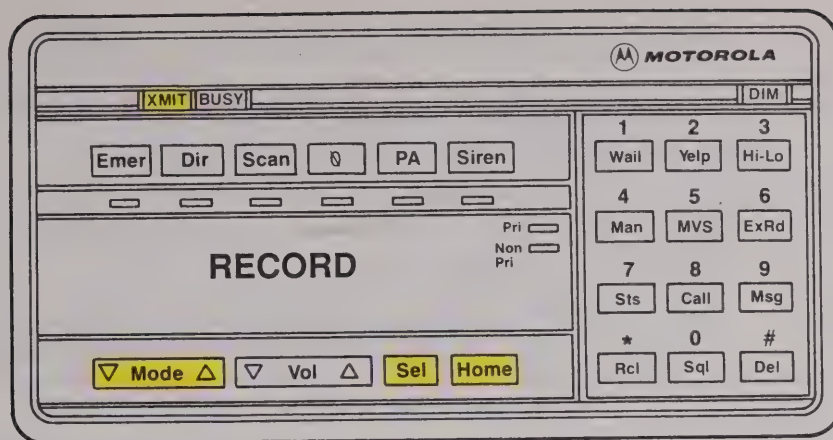
This option also includes the MDC-600 Unit ID and Emergency Alert features. Like other MDC-600 options, MVS requires field programming and will not function in a SECURENET mode if PTT ID "at end" is enabled.

*OPERATING INSTRUCTIONS

See MDC-600 UNIT ID AND EMERGENCY ALERT (W452) for operating instructions and definition of Unit ID and Emergency Alert.

[MVS] allows the operator to play, replay, record, or send voice messages. If a message from the base is waiting to be reviewed, the display alternates between "VOICE MSG" and the selected mode.

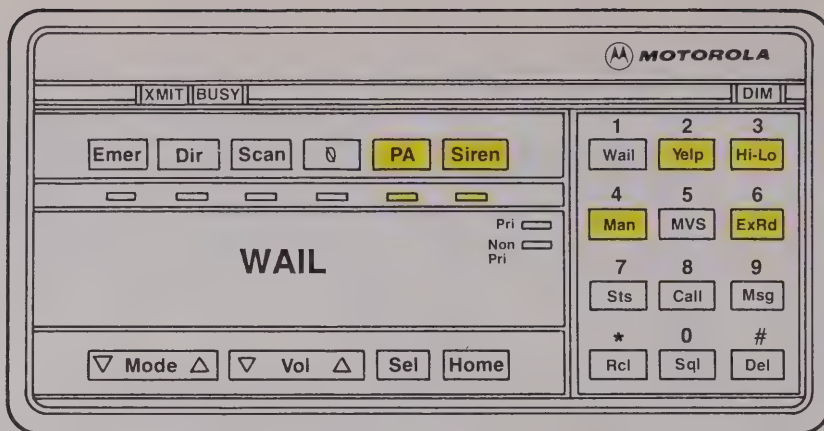
continued next page



To play the waiting message, hold the **[MVS]** button until a beep sounds. Press the **[Mode]** rocker switch until "PLAY" displays. Press **[Sel]** to play the message. Press **[Home]** to return to normal operation.

To record a message, hold the **[MVS]** button until a beep sounds. Press the **[Mode]** rocker switch until "RECORD" displays. Press the microphone PTT button and speak. When the PTT is released, the message will automatically play back for review. Scroll to "SEND" and press **[Sel]** to send notification to the dispatcher that a message is waiting. To return to normal operation, press **[Home]**.

<u>Display Shows</u>	<u>Press</u>	<u>Action</u>
PLAY	[Sel]	Plays message that is waiting
REPLAY	[Sel]	Repeats last message
RECORD	PTT	Records your voice; replays your message on PTT release
SEND	PTT or [Sel]	Sends notification to the dispatcher that a message is waiting for review



ELECTRONIC SIREN AND PUBLIC ADDRESS (W269)

The SYNTOR X 9000 radio's Siren/PA provides traffic and crowd penetrating capabilities with 100 watts of continuous duty siren output power, and 50 watts of public address output power. It also survives the grueling demands of MIL STD 810D.

Now for the first time ever, a mobile radio can have a siren/PA without increasing the size of the Control Unit. All of the controls are conveniently located in the "Systems 9000" Control Unit for ease of operation.

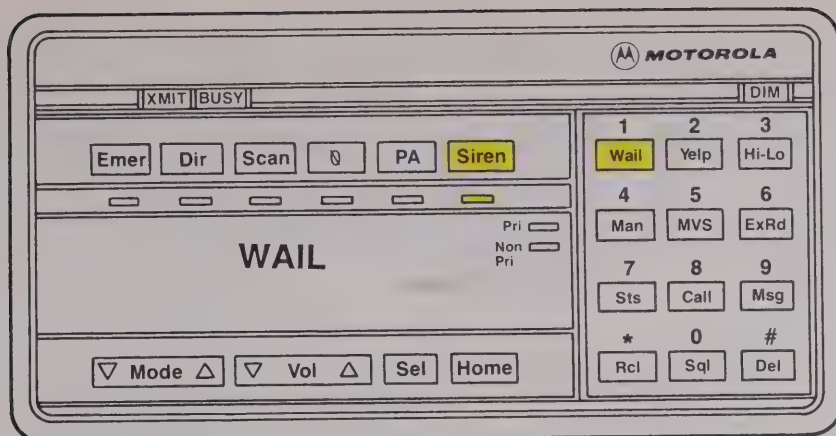
The separate amplifier can be mounted within 5 feet of the radio, alleviating the need for additional space in the driver compartment, thus enhancing operator convenience and safety.

Selections of various functions are made possible through field programming of the radio's EEPROM. Ignition sense for siren, PA, and External Radio and a default PA volume level are all field programmable. The software contains Speaker Short Detection algorithms that protect the Siren/PA in case of unexpected hardware failure. This failure will be indicated on the Control Unit display.

Note: The speaker must be rated at 11 ohms.

The various siren/PA functions include the following:

- * Four Siren Sounds
- * Manual Operations
- * External Radio
- * Public Address



* FOUR SIREN SOUNDS

The buttons for **[Wail]**, **[Yelp]**, and **[Hi-Lo]** are conveniently located on the Control Unit. Air horn is available through horn ring activation.

Press the **[Sirn]** button to activate the siren option. The status indicator will light, and the last selected siren function is activated and momentarily displayed. The operator may preselect a function by pressing the desired button on the keypad when the siren is off. The selected function will momentarily be displayed. The operator may also select a different function while the siren is on. Press the **[Sirn]** button again to turn the siren off.

* MANUAL OPERATIONS **[Man]**

Selection of this mode permits control of this siren from an alternate position (for example a footswitch or horn ring) providing the means for hands-free operation during high speed pursuits.

If the "horn-ring" feature is connected, the operator can change from one tone to another by pressing the vehicle's horn ring. This feature, programmed in the Control Head Vehicle Interface Port, is activated through a Horn Ring Transfer Relay when the siren is turned on.

ACTIVE TONE

CHANGES TO

HOW CHANGED

WAIL

YELP

Press and release the horn ring; press ring again to return to WAIL.

YELP

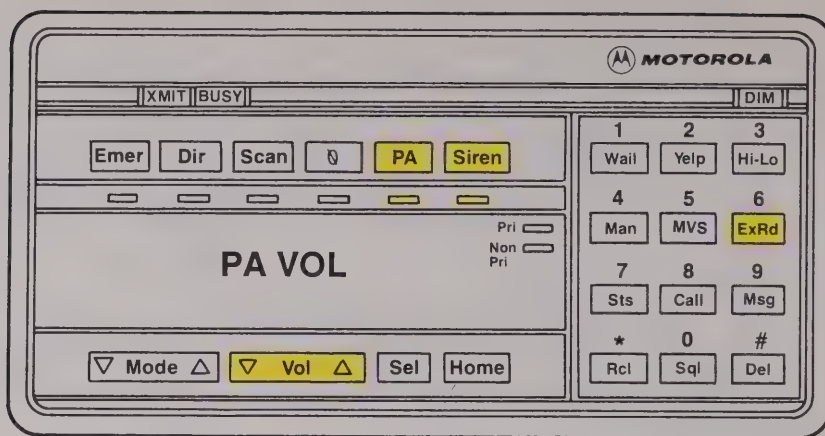
AIRHORN

Press and hold the horn ring.

HILO

YELP

Press and release the horn ring; press ring again to return to HILO.



* EXTERNAL RADIO [ExRd]

In this mode the radio's receive audio output is amplified by the siren system and reproduced through the siren speaker. This feature is especially desirable when the operator is out of the vehicle but must continue to monitor radio messages.

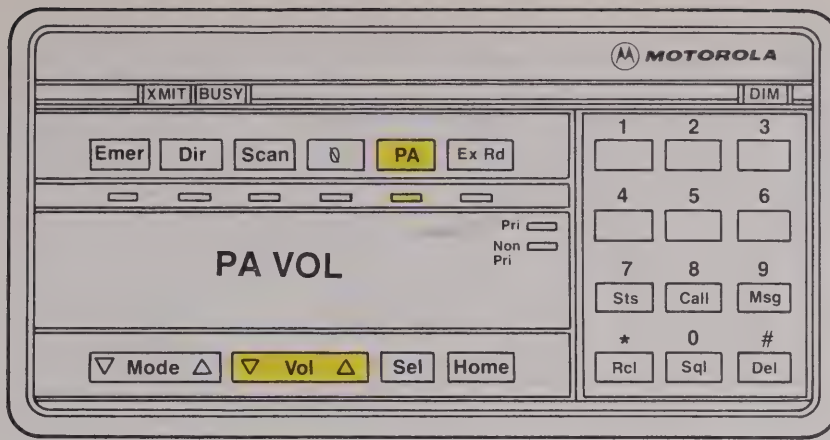
Through field programming, optional audio such as SECURE coded messages will not be routed externally.

To activate, first press [ExRd], then press [Sirn]. Any incoming radio messages will be re-broadcast over the external speaker. If the siren is sounding and the [ExRd] button is pressed, the siren tone is muted abruptly and incoming radio messages are broadcast over the external speaker. The [Vol] rocker controls the PA speaker volume. Changing its setting does not affect the radio volume setting or siren intensity. On power-up, the siren function remembers its last setting. The External Radio feature will remain operative until the [Sirn] button is pressed again, or another siren function Wail, Yelp, etc. is selected.

* PUBLIC ADDRESS [PA]

Public address announcements may be made over the siren speaker using the same microphone provided with the radio. When the PA mode is selected, the microphone will not key the radio transmitter. The PA will also override the siren sound if PTT is pressed. Upon completion of the PA message, the siren sound will automatically continue when PTT is released.

Press [PA] to select the public address option. Use [Vol] to control PA volume, indicated on the display by "PA VOL". Changing the PA volume setting does not affect the radio volume. The public address overrides all siren functions when PTT is pressed if both siren and PA are selected.



PUBLIC ADDRESS (W589)

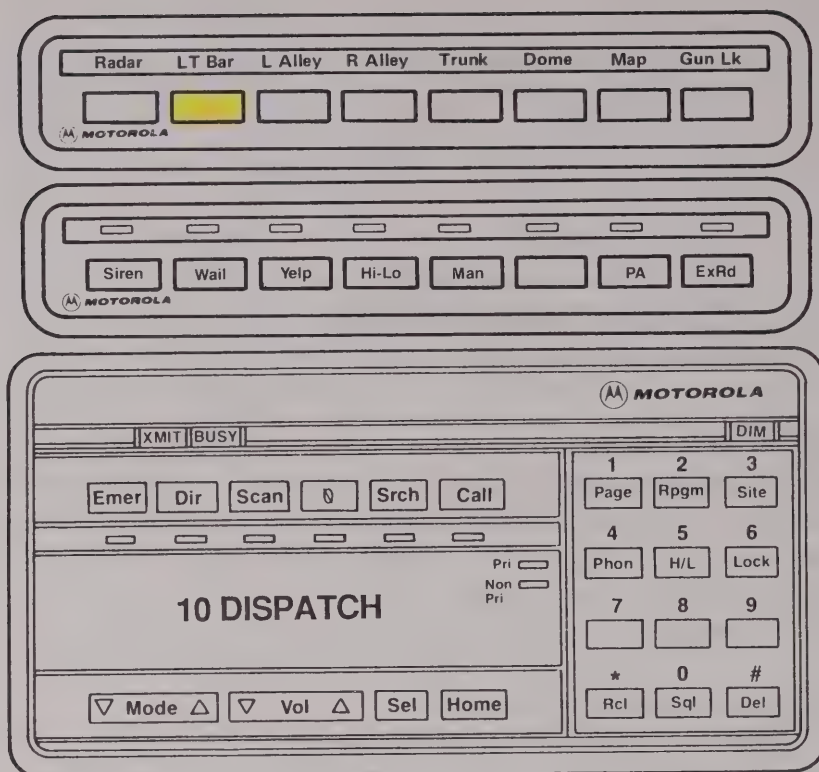
This option is for users that require PA and External Radio but not the siren capabilities. It uses the same amplifier as the Siren/PA option and provides 50 watts of Public Address output power. This option also provides the External Radio features and maintains the Mil Std 810D environmental integrity.

For operating instructions see (W269)

Note: The [ExRd] button now turns the external radio option off/on and is located in the indicator row.

Performance Specifications Electrical Characteristics

PARAMETER	MINIMUM	TYPICAL	MAXIMUM	CONDITIONS
CURRENT DRAIN			8.0 amps	@ 50 watts output with Public Address ON
PUBLIC ADDRESS AUDIO DISTORTION			10%	@ 50 watts output with 80 mV, 1 kHz signal
PUBLIC ADDRESS RATED AUDIO	50 watts			
SIREN RATED OUTPUT		100 watts +or- 10%		@ 13.80 Vdc
SIREN RATED OUTPUT		100 watts +or- 10%		@ 16.60 Vdc
CURRENT DRAIN			13 amps	siren tones ON
FREQ. RESPONSE		No more than +or- 3dB var.		@ f = 200Hz to f = 10 kHz; ref: 80 mV, 1 kHz signal
REQUIRED SPKR. IMPEDANCE		11 ohms		

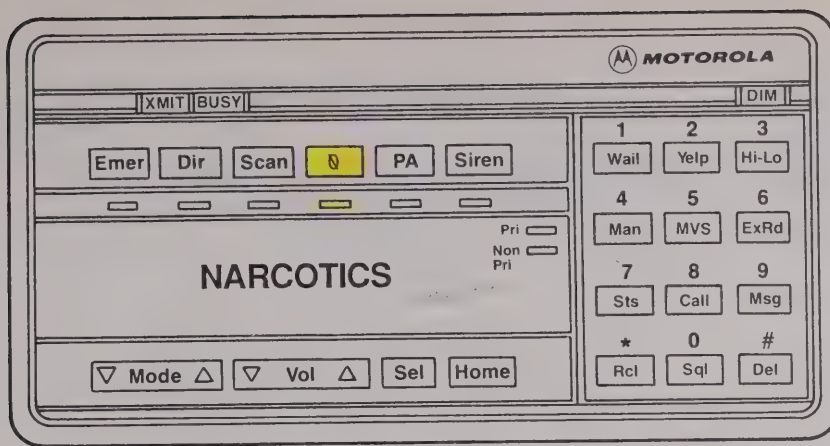


AUXILIARY SWITCH PANEL (W591)

This provides a supplemental bank of eight (8) switches that can be used to control any of the electrical functions in the vehicle. The first six buttons are push-on/push-off type and the last two are momentary. The buttons are positioned in an attractive supplemental housing that mounts directly above the Control Unit, using the same mounting bracket.

Some suggested uses are winch operation, door locks, gun locks, dome lights, Mars lights, burglar alarm, and many others. A selection of labels is provided with each panel.

This housing is not environmentally sealed and does not meet MIL STD 810D. Relays can be ordered from NPD.



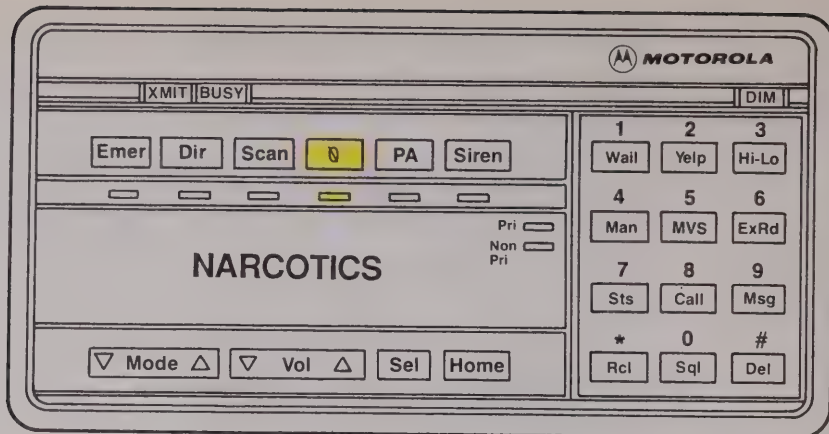
"SECURENET" ENCRYPTION OPTIONS (W794) & (W797)

When sensitive information must be transmitted by radio, MOTOROLA's SECURENET Digital Voice Protection system will provide the high level of voice security necessary to make radio communications a more effective tool.

The SECURENET DVP system is capable of providing 2.36×10^{21} unique, unrelated codes. To exemplify the vast number of codes available, a high speed computer processing 100 million instructions per second would require 748,000 years to evaluate this number of codes. Only one code out of 2.36×10^{21} possibilities will produce an intelligible message. There are no families of codes which are capable of providing a partially decoded message. Due to the coding format, the transmission contains no voice components and therefore will sound like white noise to an unauthorized listener.

The SECURENET circuitry digitizes microphone audio, transforms it into cipher, and sends it to the transmitter circuits. Similarly, it transforms received cipher into audio and sends it to the speaker. Logic circuits and audio switches allow the system to operate in either the private (encrypted) mode or the standard (clear) mode.

The private mode uses a digital non-linear coding scheme to digitize microphone audio. This scheme applies the output of a continuously-variable-slope delta modulator (CVSD) to a nonlinear digital encryption circuit. After being filtered, the encrypted data modulates the synthesizer. In the receive mode, cipher from the discriminator goes to a decoder. The CVSD converts the digital output of the decoder to an analog signal and sends it to a filter that shapes it and sends it on to the speaker amplifier circuit.



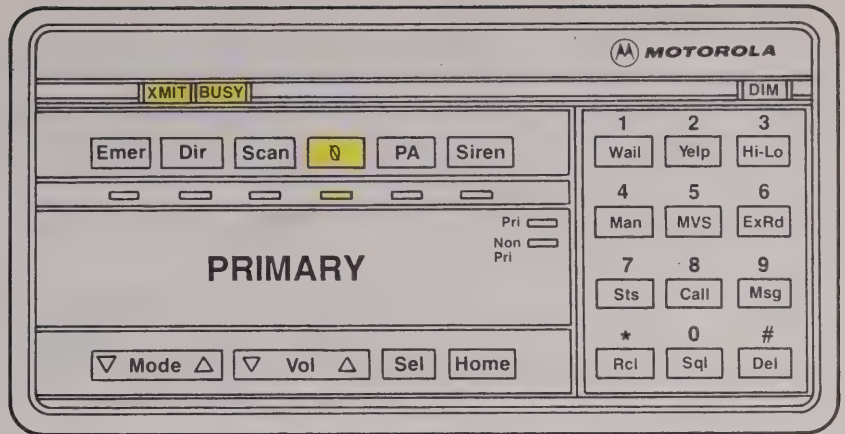
The system stores the code internally, and once the code is loaded it cannot be read. A single electronic key inserter with appropriate interconnect cable allows for a new key to be easily loaded on any schedule. The operator uses the [Q] button on the Control Unit to choose either the clear or coded mode for transmitting.

Physically the SECURENET circuitry is on a single board in the radio. The board uses a microprocessor to perform the audio switching and control functions that control the SYNTOR X 9000 radio. On the cable connector at the front of the radio is a six-pin connector through which the electronic encryption key is loaded into the SECURENET board.

Through field programming of Siren functions, SECURE receive transmissions are inhibited from being routed through the External Radio (ExRd) audio

All of the following functions are available through field programming:

- * Dual Code allows for a second code key - with DVP encryption, or selects either XL or non-XL operation with DVP-XL and DES-XL.
- * Dual Code Type - either operator select or mode slaved.
- * On/Off Operation Control - either operator select or mode slaved .
- * Proper Code Detect - enabled or disabled.
- * Receive clear alert tone sounds when a clear signal is received and the SECURENET option is turned on.
- * System Security Monitor - disables the radio if the SECURENET code fails.
- * XL Option - enables features of DVP-XL and DES-XL encryption.
- * Squelch Level Change with Scan - if XL option is enabled and scan is turned on, the squelch level will change to a preselected level which will improve scanning sensitivity for weak secure signals.
- * Echo Muting Time - Allows a programmable mute-time delay (0 to 750 mS in 25 mS) to mute possible echos following Securenets transmissions.



* OPERATING INSTRUCTIONS

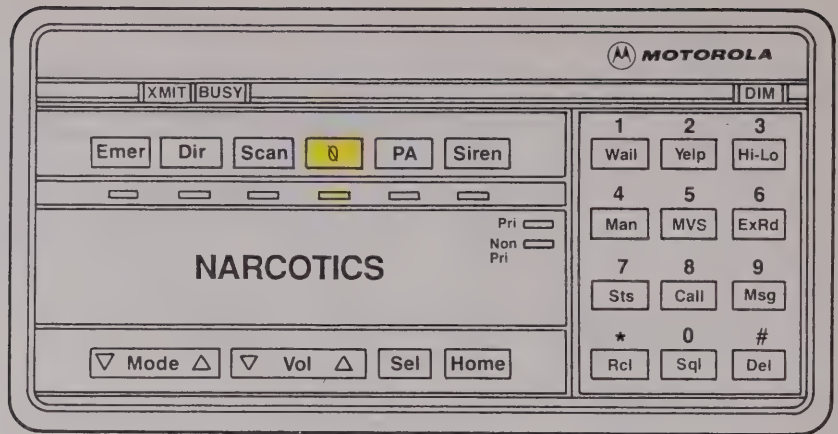
To transmit a coded message, press the [**Q**]. Doing this lights an indicator directly below the button. If the optional Dual Code feature is enabled, the current Code name temporarily displays when the option is turned on.

When the radio is receiving a coded message, the busy light will flash and the radio unmutes. When transmitting a coded message, the transmit indicator will flash. The SECURENET on/off button does not affect receive messages.

Coded messages encrypted with a different key unmute the radio and produce noise in the speaker. The Proper Code Detect option (W304) eliminates this noise by muting the audio when an incorrect encryption key is detected. This option will ship enabled. It can be totally disabled through field programming or temporarily disabled by taking the microphone off-hook or by using the monitor off/on function.

The SECURENET transmit operation may be mode slaved through field programming. On each mode the option can be slaved on (Transmit coded), off (Transmit clear), or left to operator selection. This allows the customer to ensure that when the mobile operator talks on a selected mode, the transmissions will be coded. In this case, the [**Q**] button does not have to be pressed, yet the indicator light will activate upon selection of the coded slaved mode. If the [**Q**] button is pressed on a mode that is mode slaved, an invalid entry alert tone sounds.

When enabled, a Receive Clear Alert Tone will be heard by the operator if the SECURENET option is turned on and a clear transmission is received. This feature ships from the factory disabled and is not compatible with systems having data preamble before voice transmissions. For example, MDC PTT ID or Single Tone signalling.

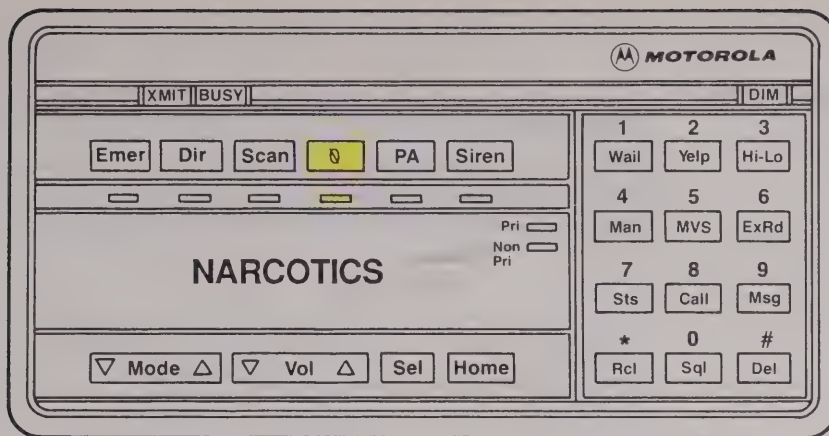


A standard feature found on DVP-XL, DES, and DES-XL equipped radios is an Audible and Visual Alert to warn the operator if the encryption key has failed when a coded transmission has begun.

Another standard feature found on all SECURENET equipped models is an alert tone to warn the operator when transmitting in the clear mode. This is active all the time.

CODE STORAGE (W268)

This option provides a lithium battery located on the common circuits board. The battery will supply power for code retention in the event of power loss to the radio.



DES and DES-XL Equipped Models (W388) & (W795)

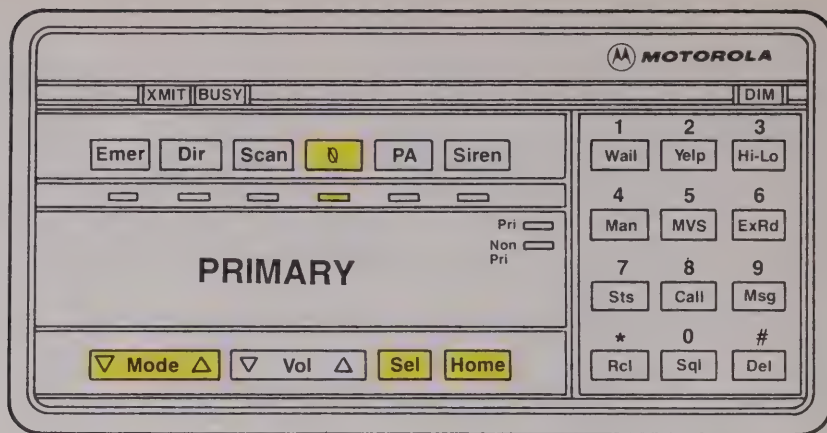
DES stands for Data Encryption Standard and is a National Bureau of Standards encryption method for protecting all forms of digital communications. The encryption is performed by a DES hybrid and is capable of accepting any one of 7.6×10^{16} different keys, all which are available from the handheld Key Variable Loader. DES equipped radios will not communicate with DVP equipped radios while in the encrypted mode. Dual Code is not available with DES or DES-XL.

The optional DES Security Housing provides a physically secure environment for DES and DES-XL encryption circuitry. It includes locks to inhibit coded operation (both transmit and receive) and encryption key entry. It also features an anti-tamper switch that erases the encryption key when the housing is disassembled and an external key reset for operator controlled key erasure.

Physically the SECURENET circuitry is on a single circuit board located inside the security housing. The circuit board uses a microprocessor to perform the audio switching and control functions for the SYNTOR X 9000 radio system. The electronic encryption key loads into the SECURENET board through a six-pin connector located on the front of the security housing. The Operate/Standby, Key Erase, and Keyload switches are also on the front of the housing.

The Keyload switch has a dual purpose; it allows entry into the security housing and is used in conjunction with the six-pin keyload connector. The switch must be unlocked to allow an encryption key to be transferred to the radio. Entry into the housing is allowed in the keyload position.

Continued next page



The Operate/Standby switch allows the operator to set the system to operate only in standard mode. When this switch is in the Standby position, the radio operates in the standard mode only. When set to Operate, the [0] button on the control unit selects between private (encrypted) or standard mode.

The Key Erase switch erases the electronic key and disables both encryption and decryption. This switch operates even if the radio is off. A second anti-tamper erase switch is contained inside the security housing. This switch erases the electronic key when the housing is disassembled.

DUAL CODE SELECT (W303)

This option provides an internally generated variation for the programmed code to allow a subgroup of SECURENET system radio users to communicate.

Subgrouping allows the operator to communicate privately with preassigned individuals within the system. For example, the Chief can now talk to all Captains without all SECURENET system users overhearing the conversation.

Each mode can be slaved to Code 1, Code 2, or left to operator selection.

To activate, push and hold the [0] button. An alert tone will sound and the SECURENET indicator will flash. Select the desired code from the keypad or by the [Mode] rocker. Press the [Sel] button to enter a keypad selection. If an illegal entry is made, a (beep) will sound. Press the [Home] button to exit the program mode. These codes can be displayed by a user identifiable name, number or combination of both.

DVP-XL (W797) & DES-XL (W795)

DVP-XL and DES-XL are methods of encryption that provide range characteristics equivalent to that of clear voice. The following are some of the features of radios equipped with DVP-XL and DES-XL.

- * XL (extended range) or non-XL, Selectable - provides the operator with the ability to select XL or non-XL operation for those systems that require both types of encryption.
- * Automatic Receive Operation - the radio will automatically decipher XL and non-XL transmissions.
- * Echo Muting Time - large systems may require some delay time following Securenet transmissions to cancel echoes. This delay can be set from 0 to 750 milliseconds in 25 millisecond intervals. The default value is preselected at 0.0 seconds.
- * Squelch Sensitivity with Scan On - With this feature, during Securenet operation, scanning sensitivity improves when scanning for weak Securenet signals. When Securenet operation and scan are on, the squelch level overrides the operator selected level of squelch and changes to a predetermined setting of 1 (threshold) to 4 (tight). The squelch level may not be changed when scan is on. Squelch level returns to the operator selected value when scan is turned off.

"TOUCH-CODE" ENCODE MICROPHONE (W20)

This option deletes the standard microphone and provides a Touch-Code Encode microphone. This DTMF microphone can be used as a supplement to the Control Unit keypad when DTMF/Telephone Interconnect (W946) is ordered.

When using this microphone with MDC-600 signalling or the Mobile Voice Storage option, the PTT ID data packet should be programmed to send at the end of PTT (release of the microphone PTT switch). This is needed because if programmed to send at the beginning, the data and DTMF tones would mix with undesirable results.

BROAD BAND OPERATION FOR LOW BAND ANTENNAS

"SYNTOR X 9000" LOW BAND RADIO

The radio can transmit and receive anywhere in the 31-50 MHz band with no degradation of specifications. Unfortunately there is no acceptable antenna that will cover the entire band. To compensate for the antenna limitation and still accommodate most of the low band applications we have designed some new antennas and also formulated different methods of using our existing antennas.

"SYNTOR X 9000" LOW BAND ANTENNAS

There are five different variations of antenna packages available with the SYNTOR X 9000 low band mobile radio.

- * Standard 1/4 wave whip -- allows 2 MHz separation
- * Base loaded antenna -- allows 400 kHz (0.4 MHz) separation
- * W652 Broadband -- covers 33 - 43 MHz
- * W921 Broadband -- covers 37 - 49 MHz
- * Diplex Antenna -- covers two 400 kHz (0.4 MHz) "Windows" (2 antennas)

PROGRAMMING EQUIPMENT

IBM and IBM Compatible Computer

Programming kits are available from National Parts Department which provide the necessary software and cables to use an existing IBM PC to field program the SYNTOR X 9000 radio.

Programmable conventional parameters include the ability to program frequencies, squelch codes, time-out timer, mode names, MDC-600 unit ID numbers, and all programmable options. Additional field programmable names include: Operator Select MPL, MDC-600 Selective Call unit names, Status and Message names and DTMF/Telephone Interconnect target names.

See the following pages for:

Service Aid List

Hardware and Software requirements

SYNTOR X 9000 Radio Programming Worksheet

SYNTOR X 9000 Control Head Programming Worksheet

SERVICE AID LIST

SYNTOR X 9000 MOBILE RADIO

The following service aids are available through Motorola Communications & Electronics Parts to facilitate servicing of the SYNTOR X 9000 Mobile Radios. Please contact your Area Parts Manager for price and delivery.

FIELD PROGRAMMING ▼

Model No.	Description
	SYNTOR X 9000 RADIO SERVICE HARDWARE The 9000 Radio Service software is designed to operate on the IBM PC, XT, or AT family of computers. It is suggested that one of these computers be used as the Programmer. IBM DOS 2.0 or higher, an RS232 Asynchronous Serial Communication Adapter, and RAM memory of 512K bytes minimum are necessary for programming. The software and manuals provide the user with the capability to change the radio's frequencies, mode names and other radio parameters.
01-80353A74	RADIO INTERFACE BOX (RIB) Voltage level shifter to enable communications between the radio and the computer's RS232 Serial Communication Adapter.
30-80369B71	IBM PC/XT COMPUTER INTERFACE CABLE This 25 pin cable is used to connect the computer's RS232 Asynchronous Serial Communications Adapter to the RIB (01-80353A74).
30-80369B72	IBM PC-AT COMPUTER INTERFACE CABLE This 9 pin cable is used to connect the computer's RS232 Asynchronous Serial Communications Adapter to the RIB (01-80353A74).
01-80353A75	RADIO INTERFACE ACCESSORY RIB CABLE - Used to connect the radio to the RIB box (01-80353A74).

FIELD PROGRAMMING ▼

Model No.	Description
RPX-4719	SOFTWARE LICENSING PACKAGE Contains software licensing agreement, software ordering forms, and a list of available software. This kit must be ordered prior to ordering any software.
RVN-4008	9000 RADIO SERVICE SOFTWARE ON 3 1/2 IN. DISK - Operates on computers with 3 1/2 in. floppy disk drives.
RVN-4007	9000 RADIO SERVICE SOFTWARE ON 5 1/4 IN. DISK - Operates on computers with 5 1/4 in. floppy disk drives.

SERVICE TOOLS ▼

Model No.	Description
RSX-4057	HOT AIR BONDER For instantaneous pinpoint soldering and repairing of hybrid circuits. Provides precision controlled spot heating for fast and easy repairs.
RSX-4044	ADJUSTABLE TORQUE DRIVER SET WITH BITS
01-80320B16	MAGNETIC SCREWDRIVER SET WITH BITS
	INSERTION AND EXTRACTION TOOLS
66-80163F01	Used to remove VIP connectors from the control head.
66-80371B14	Chip carrier extraction tool for MDC-1200. (Required to change software).
39-84257L01	VIP CONNECTOR-FEMALE CONTACT
09-80080L01	SHORTING PIN

Support Services



SERVICE AID LIST

SYNTOR X 9000 MOBILE RADIO

The following service aids are available through Motorola Communications & Electronics Parts to facilitate servicing of the SYNTOR X 9000 Mobile Radios. Please contact your Area Parts Manager for price and delivery.

CONVENTIONAL ACCESSORIES ▼

Model No.	Description
	SPARE ACCESSORIES GROUPS Provides all radio accessories including mounting plate. (Excludes antenna and manuals).
RPX-1026A	SPARE ACCESSORIES GROUP
RPX-1025A	SECURE CAPABLE SPARE ACCESSORIES GROUP
H1077A	SPARE CONTROL HEAD-32 MODE
H1110A	SPARE CONTROL HEAD-64 MODE
HKN4241A	RADIO POWER CABLE
HKN4256A	SECURE CAPABLE RADIO POWER CABLE

CONVENTIONAL SERVICE MANUALS ▼

Model No.	Description
68-80100W94	9000 SERVICE MANUAL
68-80101W95	LOW BAND MANUAL
68-81060E05	VHF MANUAL
68-80100W45	UHF MANUAL
68-81044E40	800 MHz MANUAL

TRUNKING ACCESSORIES ▼

Model No.	Description
RPX-1029A	TRUNKING SPARE ACCESSORIES GROUP Provides all trunked radio accessories including mounting plate. (Excludes antenna and manuals).
H1073A	SPARE CONTROL HEAD
H1071A	SMARTNET SPARE MEMORY MODULE Provides trunking code plug (Requires trunking control number).
H1072A	PRIVACY PLUS SPARE MEMORY MODULE Provides trunking code plug (Requires trunking control number).
HKN4241	RADIO POWER CABLE

TRUNKING SERVICE MANUALS ▼

Model No.	Description
68-80100W89	9000 SERVICE MANUAL
68-81066E80	RADIO MANUAL

Support Services



13.0 APPENDIX A

SYNTOR X 9000 RADIO PROGRAMMING WORKSHEET

RADIO DESCRIPTION: _____

SYSTEM INFORMATION	
RADIO	
BAND/FREQUENCY RANGE	
NUMBER OF USER MODES	
NUMBER OF OPTION MODES	
HOME MODE	
DEFAULT RADIO VOLUME LEVEL	
DEFAULT SQUELCH SETTING	
MODE CHANGE ALERT TONE	YES, NO
INVALID TX MODE ALERT ZONE	YES, NO
IGNITION SENSE FOR TRANSMITTER	ALL TX INHIBITED, UNINHIBITED, PTT INHIBITED
SCAN	
NUISANCE CHANNEL DELETE	YES, NO
DYNAMIC PRIORITY ASSIGNMENT	YES, NO
ALERT TONE ON ACTIVE PRIORITY 1	YES, NO
ALERT TONE ON ACTIVE PRIORITY 2	YES, NO
SCAN RECEIVE HANG TIME	
SCAN TRANSMIT HANG TIME	

SYNTOR X 9000 RADIO PROGRAMMING WORKSHEET

USER MODE INFORMATION	MODE____	MODE____	MODE____	MODE____
TX FREQUENCY (MHz)				
RX FREQUENCY (MHz)				
ALT. TX FREQUENCY (MHz)				
TIME OUT TIMER				
PTT ALLOWED	YES, NO	YES, NO	YES, NO	YES, NO
TX SQUELCH	PL	PL	PL	PL
	DPL	DPL	DPL	DPL
	CSQ	CSQ	CSQ	CSQ
RX SQUELCH	PL	PL	PL	PL
	DPL	DPL	DPL	DPL
	CSQ	CSQ	CSQ	CSQ
OPERATOR SELECT MPL	RX & TX, TX, RX, OFF	RX & TX, TX, RX, OFF	RX & TX, TX, RX, OFF	RX & TX, TX, RX, OFF
REVERSE BURST	YES, NO	YES, NO	YES, NO	YES, NO
EXTENDER	YES, NO	YES, NO	YES, NO	YES, NO
UNMUTE / MUTE TYPE	STD / STD AND / STD AND / OR	STD / STD AND / STD AND / OR	STD / STD AND / STD AND / OR	STD / STD AND / STD AND / OR
SCAN ENABLE	OFF, OP.SEL.	OFF, OP.SEL.	OFF, OP.SEL.	OFF, OP.SEL.
TALKBACK SCAN	YES, NO	YES, NO	YES, NO	YES, NO
SCAN SQUELCH	CSQ, CODED	CSQ, CODED	CSQ, CODED	CSQ, CODED
PRIORITY ONE MODE				
PRIORITY TWO MODE				
NONPRIORITY MODES				

SYNTOR X 9000 RADIO PROGRAMMING WORKSHEET

OPTION MODE INFORMATION	MODE____	MODE____	MODE____	MODE____
TX FREQUENCY (MHz)				
RX FREQUENCY (MHz)				
TIME-OUT TIMER				
TX SQUELCH	PL		PL	
	DPL		DPL	
	CSQ	CSQ	CSQ	CSQ
RX SQUELCH	PL		PL	
	DPL		DPL	
	CSQ	CSQ	CSQ	CSQ
REVERSE BURST	YES, NO	YES, NO	YES, NO	YES, NO
EXTENDER	YES, NO	YES, NO	YES, NO	YES, NO
UNMUTE / MUTE TYPE	STD / STD AND / STD AND / OR	STD / STD AND / STD AND / OR	STD / STD AND / STD AND / OR	STD / STD AND / STD AND / OR

SYNTOR X 9000 RADIO PROGRAMMING WORKSHEET

NUMBER OF OPERATOR SELECT MPL CODES —

OPERATOR SELECT MPL	MPL 1		MPL 2		MPL 3		MPL 4	
TX SQUELCH	PL		PL		PL		PL	
	DPL		DPL		DPL		DPL	
	CSQ		CSQ		CSQ		CSQ	
RX SQUELCH	PL		PL		PL		PL	
	DPL		DPL		DPL		DPL	
	CSQ		CSQ		CSQ		CSQ	
OPERATOR SELECT MPL	MPL 5		MPL 6		MPL 7		MPL 8	
TX SQUELCH	PL		PL		PL		PL	
	DPL		DPL		DPL		DPL	
	CSQ		CSQ		CSQ		CSQ	
RX SQUELCH	PL		PL		PL		PL	
	DPL		DPL		DPL		DPL	
	CSQ		CSQ		CSQ		CSQ	
OPERATOR SELECT MPL	MPL 9		MPL 10		MPL 11		MPL 12	
TX SQUELCH	PL		PL		PL		PL	
	DPL		DPL		DPL		DPL	
	CSQ		CSQ		CSQ		CSQ	
RX SQUELCH	PL		PL		PL		PL	
	DPL		DPL		DPL		DPL	
	CSQ		CSQ		CSQ		CSQ	
OPERATOR SELECT MPL	MPL 13		MPL 14		MPL 15		MPL 16	
TX SQUELCH	PL		PL		PL		PL	
	DPL		DPL		DPL		DPL	
	CSQ		CSQ		CSQ		CSQ	
RX SQUELCH	PL		PL		PL		PL	
	DPL		DPL		DPL		DPL	
	CSQ		CSQ		CSQ		CSQ	

SYNTOR X 9000 RADIO PROGRAMMING WORKSHEET

SIREN (W269)

HILO / AIRHORN SIREN MODE	YES, NO
MANUAL SIREN TONE	WAIL, YELP, AIRHORN
IGNITION SENSE FOR SIREN	YES, NO

PUBLIC ADDRESS (W269 or W589)

OPTION AUDIO P.A. ROUTING	YES, NO
IGNITION SENSE FOR PUBLIC ADDRESS	YES, NO
IGNITION SENSE FOR EXTERNAL RADIO	YES, NO
DEFAULT P.A. VOLUME LEVEL	

SYNTOR X 9000 RADIO PROGRAMMING WORKSHEET

BASIC SECURENET

SYSTEM SECURITY MONITOR	YES, NO
DUAL CODE	YES, NO
DUAL CODE TYPE	OPERATOR SELECT, MODE SLAVED
ON / OFF OPERATION CONTROL	OPERATOR SELECT, MODE SLAVED
KEY FAIL ALERT TONE	YES, NO
CLEAR TRANSMIT ALERT TONE	YES, NO
PL OVERRIDE ALERT TONE	YES, NO

FULL FEATURED SECURENET

SYSTEM SECURITY MONITOR	YES, NO
DUAL CODE	YES, NO
DUAL CODE TYPE	OPERATOR SELECT, MODE SLAVED
ON / OFF OPERATION CONTROL	OPERATOR SELECT, MODE SLAVED
RECEIVE CLEAR ALERT TONE	YES, NO
PROPER CODE DETECT	YES, NO

SYNTOR X 9000 RADIO PROGRAMMING WORKSHEET

SECURENET

MODE SLAVED DUAL CODE

MODE		MODE	
1	CODE 1, CODE 2, OP. SELECT	33	CODE 1, CODE 2, OP. SELECT
2	CODE 1, CODE 2, OP. SELECT	34	CODE 1, CODE 2, OP. SELECT
3	CODE 1, CODE 2, OP. SELECT	35	CODE 1, CODE 2, OP. SELECT
4	CODE 1, CODE 2, OP. SELECT	36	CODE 1, CODE 2, OP. SELECT
5	CODE 1, CODE 2, OP. SELECT	37	CODE 1, CODE 2, OP. SELECT
6	CODE 1, CODE 2, OP. SELECT	38	CODE 1, CODE 2, OP. SELECT
7	CODE 1, CODE 2, OP. SELECT	39	CODE 1, CODE 2, OP. SELECT
8	CODE 1, CODE 2, OP. SELECT	40	CODE 1, CODE 2, OP. SELECT
9	CODE 1, CODE 2, OP. SELECT	41	CODE 1, CODE 2, OP. SELECT
10	CODE 1, CODE 2, OP. SELECT	42	CODE 1, CODE 2, OP. SELECT
11	CODE 1, CODE 2, OP. SELECT	43	CODE 1, CODE 2, OP. SELECT
12	CODE 1, CODE 2, OP. SELECT	44	CODE 1, CODE 2, OP. SELECT
13	CODE 1, CODE 2, OP. SELECT	45	CODE 1, CODE 2, OP. SELECT
14	CODE 1, CODE 2, OP. SELECT	46	CODE 1, CODE 2, OP. SELECT
15	CODE 1, CODE 2, OP. SELECT	47	CODE 1, CODE 2, OP. SELECT
16	CODE 1, CODE 2, OP. SELECT	48	CODE 1, CODE 2, OP. SELECT
17	CODE 1, CODE 2, OP. SELECT	49	CODE 1, CODE 2, OP. SELECT
18	CODE 1, CODE 2, OP. SELECT	50	CODE 1, CODE 2, OP. SELECT
19	CODE 1, CODE 2, OP. SELECT	51	CODE 1, CODE 2, OP. SELECT
20	CODE 1, CODE 2, OP. SELECT	52	CODE 1, CODE 2, OP. SELECT
21	CODE 1, CODE 2, OP. SELECT	53	CODE 1, CODE 2, OP. SELECT
22	CODE 1, CODE 2, OP. SELECT	54	CODE 1, CODE 2, OP. SELECT
23	CODE 1, CODE 2, OP. SELECT	55	CODE 1, CODE 2, OP. SELECT
24	CODE 1, CODE 2, OP. SELECT	56	CODE 1, CODE 2, OP. SELECT
25	CODE 1, CODE 2, OP. SELECT	57	CODE 1, CODE 2, OP. SELECT
26	CODE 1, CODE 2, OP. SELECT	58	CODE 1, CODE 2, OP. SELECT
27	CODE 1, CODE 2, OP. SELECT	59	CODE 1, CODE 2, OP. SELECT
28	CODE 1, CODE 2, OP. SELECT	60	CODE 1, CODE 2, OP. SELECT
29	CODE 1, CODE 2, OP. SELECT	61	CODE 1, CODE 2, OP. SELECT
30	CODE 1, CODE 2, OP. SELECT	62	CODE 1, CODE 2, OP. SELECT
31	CODE 1, CODE 2, OP. SELECT	63	CODE 1, CODE 2, OP. SELECT
32	CODE 1, CODE 2, OP. SELECT	64	CODE 1, CODE 2, OP. SELECT

SECURENET

MODE SLAVED ON/OFF OPERATION

MODE		MODE	
1	OFF, ON, OP. SELECT	33	OFF, ON, OP. SELECT
2	OFF, ON, OP. SELECT	34	OFF, ON, OP. SELECT
3	OFF, ON, OP. SELECT	35	OFF, ON, OP. SELECT
4	OFF, ON, OP. SELECT	36	OFF, ON, OP. SELECT
5	OFF, ON, OP. SELECT	37	OFF, ON, OP. SELECT
6	OFF, ON, OP. SELECT	38	OFF, ON, OP. SELECT
7	OFF, ON, OP. SELECT	39	OFF, ON, OP. SELECT
8	OFF, ON, OP. SELECT	40	OFF, ON, OP. SELECT
9	OFF, ON, OP. SELECT	41	OFF, ON, OP. SELECT
10	OFF, ON, OP. SELECT	42	OFF, ON, OP. SELECT
11	OFF, ON, OP. SELECT	43	OFF, ON, OP. SELECT
12	OFF, ON, OP. SELECT	44	OFF, ON, OP. SELECT
13	OFF, ON, OP. SELECT	45	OFF, ON, OP. SELECT
14	OFF, ON, OP. SELECT	46	OFF, ON, OP. SELECT
15	OFF, ON, OP. SELECT	47	OFF, ON, OP. SELECT
16	OFF, ON, OP. SELECT	48	OFF, ON, OP. SELECT
17	OFF, ON, OP. SELECT	49	OFF, ON, OP. SELECT
18	OFF, ON, OP. SELECT	50	OFF, ON, OP. SELECT
19	OFF, ON, OP. SELECT	51	OFF, ON, OP. SELECT
20	OFF, ON, OP. SELECT	52	OFF, ON, OP. SELECT
21	OFF, ON, OP. SELECT	53	OFF, ON, OP. SELECT
22	OFF, ON, OP. SELECT	54	OFF, ON, OP. SELECT
23	OFF, ON, OP. SELECT	55	OFF, ON, OP. SELECT
24	OFF, ON, OP. SELECT	56	OFF, ON, OP. SELECT
25	OFF, ON, OP. SELECT	57	OFF, ON, OP. SELECT
26	OFF, ON, OP. SELECT	58	OFF, ON, OP. SELECT
27	OFF, ON, OP. SELECT	59	OFF, ON, OP. SELECT
28	OFF, ON, OP. SELECT	60	OFF, ON, OP. SELECT
29	OFF, ON, OP. SELECT	61	OFF, ON, OP. SELECT
30	OFF, ON, OP. SELECT	62	OFF, ON, OP. SELECT
31	OFF, ON, OP. SELECT	63	OFF, ON, OP. SELECT
32	OFF, ON, OP. SELECT	64	OFF, ON, OP. SELECT

SYNTOR X 9000 RADIO PROGRAMMING WORKSHEET

DTMF UNIT CALL/TELEPHONE INTERCONNECT

DTMF UNIT CALL ENCODE & DECODE	YES, NO
TELEPHONE INTERCONNECT ENCODE	YES, NO
TELEPHONE INTERCONNECT DECODE	YES, NO
GROUP	
UNIT ID	
SYSTEM DELAY	MS
DIGIT/INTERDIGIT TIME	MS
MODE SLAVED DTMF UNIT CALL	YES, NO
MODE SLAVED TELEPHONE	YES, NO
AUTO CONNECT CODE	
AUTO DISCONNECT CODE	
KEYPAD ENABLED	YES, NO
SYSTEM DELAY	OFF, ON
HORN DURATION	SECONDS
LIGHTS DURATION	SECONDS

MDC-600 (W681, W824 or W825)

FLEET	
GROUP	
UNIT	
SYSTEM DELAY	
SEL CALL DECODE	YES, NO
MUTING TYPE	AND, OR, NONE
DISPLAY ID	YES, NO
HORN DURATION	
LIGHT DURATION	
SEL CALL ENCODE	YES, NO
UNIT ENCODE	YES, NO
RX ID DISPLAY	YES, NO
MESSAGE	YES, NO
NUMBER OF MESSAGES	
STATUS	YES, NO
NUMBER OF STATUSES	
STATUS / MESSAGE MODE	
PTT ID / EMERGENCY ALERT	YES, NO
PTT ID TYPE	ON BEGIN, ON END, ON BEGIN AND END
PTT ID SIDETONE	YES, NO
EMERGENCY MODE	
SILENT ALARM	YES, NO
STATUS WITH PTT ID	YES, NO
MODE SLAVED PTT ID/SEL CALL ENCODE	YES, NO
NUMBER OF UNIT NAMES	

SYNTOR X 9000 RADIO PROGRAMMING WORKSHEET

MDC-600 (W681, W824 or W825)

MODE SLAVED PTT ID / SEL CALL ENCODE

MODE		MODE	
1	OFF, ON	33	OFF, ON
2	OFF, ON	34	OFF, ON
3	OFF, ON	35	OFF, ON
4	OFF, ON	36	OFF, ON
5	OFF, ON	37	OFF, ON
6	OFF, ON	38	OFF, ON
7	OFF, ON	39	OFF, ON
8	OFF, ON	40	OFF, ON
9	OFF, ON	41	OFF, ON
10	OFF, ON	42	OFF, ON
11	OFF, ON	43	OFF, ON
12	OFF, ON	44	OFF, ON
13	OFF, ON	45	OFF, ON
14	OFF, ON	46	OFF, ON
15	OFF, ON	47	OFF, ON
16	OFF, ON	48	OFF, ON
17	OFF, ON	49	OFF, ON
18	OFF, ON	50	OFF, ON
19	OFF, ON	51	OFF, ON
20	OFF, ON	52	OFF, ON
21	OFF, ON	53	OFF, ON
22	OFF, ON	54	OFF, ON
23	OFF, ON	55	OFF, ON
24	OFF, ON	56	OFF, ON
25	OFF, ON	57	OFF, ON
26	OFF, ON	58	OFF, ON
27	OFF, ON	59	OFF, ON
28	OFF, ON	60	OFF, ON
29	OFF, ON	61	OFF, ON
30	OFF, ON	62	OFF, ON
31	OFF, ON	63	OFF, ON
32	OFF, ON	64	OFF, ON

SYNTOR X 9000 RADIO PROGRAMMING WORKSHEET

MDC-600 and MOBILE VOICE STORAGE (W452, W711 or W712)

FLEET	
GROUP	
UNIT	
SYSTEM DELAY	
PLAYBACK LENGTH	NORMAL, LONG
PTT ID / EMERGENCY ALERT	YES, NO
PTT ID TYPE	ON BEGIN, ON END, ON BEGIN AND END
PTT ID SIDETONE	YES, NO
MODE SLAVED PTT ID	YES, NO
EMERGENCY MODE	
SILENT ALARM	YES, NO

SYNTOR X 9000 RADIO PROGRAMMING WORKSHEET

MDC-600 and MOBILE VOICE STORAGE (W452, W711 or W712)

MODE SLAVED PTT ID

MODE		MODE	
1	OFF, ON	33	OFF, ON
2	OFF, ON	34	OFF, ON
3	OFF, ON	35	OFF, ON
4	OFF, ON	36	OFF, ON
5	OFF, ON	37	OFF, ON
6	OFF, ON	38	OFF, ON
7	OFF, ON	39	OFF, ON
8	OFF, ON	40	OFF, ON
9	OFF, ON	41	OFF, ON
10	OFF, ON	42	OFF, ON
11	OFF, ON	43	OFF, ON
12	OFF, ON	44	OFF, ON
13	OFF, ON	45	OFF, ON
14	OFF, ON	46	OFF, ON
15	OFF, ON	47	OFF, ON
16	OFF, ON	48	OFF, ON
17	OFF, ON	49	OFF, ON
18	OFF, ON	50	OFF, ON
19	OFF, ON	51	OFF, ON
20	OFF, ON	52	OFF, ON
21	OFF, ON	53	OFF, ON
22	OFF, ON	54	OFF, ON
23	OFF, ON	55	OFF, ON
24	OFF, ON	56	OFF, ON
25	OFF, ON	57	OFF, ON
26	OFF, ON	58	OFF, ON
27	OFF, ON	59	OFF, ON
28	OFF, ON	60	OFF, ON
29	OFF, ON	61	OFF, ON
30	OFF, ON	62	OFF, ON
31	OFF, ON	63	OFF, ON
32	OFF, ON	64	OFF, ON

SYNTOR X 9000 CONTROL HEAD PROGRAMMING WORKSHEET

RADIO DESCRIPTION: _____

KEYPAD BUTTON PROGRAMMING

BUTTON	FUNCTION
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____

VEHICLE INTERFACE PORTS

BUTTON	FUNCTION
VIP INPUT 1	_____
VIP INPUT 2	_____
VIP INPUT 3	_____
VIP OUTPUT 1	_____
VIP OUTPUT 2	_____
VIP OUTPUT 3	_____

INDICATOR BUTTON PROGRAMMING

BUTTON	FUNCTION
18	_____
19	_____
20	_____
21	_____
22	_____
23	_____

DIRECT ENTRY KEYPAD BUTTON PROGRAMMING

BUTTON	FUNCTION
BOX #1	
24	_____
25	_____
26	_____
27	_____
28	_____
29	_____
30	_____
31	_____

BOX #2

32	_____
33	_____
34	_____
35	_____
36	_____
37	_____
38	_____
39	_____

SYNTOR X 9000 CONTROL HEAD PROGRAMMING WORKSHEET

DISPLAY NAMES

NUMBER OF MODE NAMES	_____	(0-32, 0-64 with W930)
NUMBER OF OPERATOR SELECT MPL NAMES	_____	(0-16)
NUMBER OF SECURENET CODE/KEY NAMES	_____	(0-8)
NUMBER OF MESSAGE NAMES	_____	(0-20)
NUMBER OF STATUS NAMES	_____	(0-20)
NUMBER OF MDC-600 UNIT NAMES	_____	(0-63)

MODE NAMES

NAME #	MODE NAME	NAME #	MODE NAME
1	_____	33	_____
2	_____	34	_____
3	_____	35	_____
4	_____	36	_____
5	_____	37	_____
6	_____	38	_____
7	_____	39	_____
8	_____	40	_____
9	_____	41	_____
10	_____	42	_____
11	_____	43	_____
12	_____	44	_____
13	_____	45	_____
14	_____	46	_____
15	_____	47	_____
16	_____	48	_____
17	_____	49	_____
18	_____	50	_____
19	_____	51	_____
20	_____	52	_____
21	_____	53	_____
22	_____	54	_____
23	_____	55	_____
24	_____	56	_____
25	_____	57	_____
26	_____	58	_____
27	_____	59	_____
28	_____	60	_____
29	_____	61	_____
30	_____	62	_____
31	_____	63	_____
32	_____	64	_____

SYNTOR X 9000 CONTROL HEAD PROGRAMMING WORKSHEET

OPERATOR SELECT MPL NAMES

NAME #	MPL NAME
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____

NAME #	MPL NAME
9	_____
10	_____
11	_____
12	_____
13	_____
14	_____
15	_____
16	_____

SECURENET CODE/KEY NAMES

NAME #	CODE/KEY NAME
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____

MESSAGE NAMES

NAME #	MESSAGE NAME
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____
10	_____

NAME #	MESSAGE NAME
11	_____
12	_____
13	_____
14	_____
15	_____
16	_____
17	_____
18	_____
19	_____
20	_____

STATUS NAMES

NAME #	STATUS NAME
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____
10	_____

NAME #	STATUS NAME
11	_____
12	_____
13	_____
14	_____
15	_____
16	_____
17	_____
18	_____
19	_____
20	_____

SYNTOR X 9000 CONTROL HEAD PROGRAMMING WORKSHEET

MDC-600 UNIT NAMES AND ID

NAME #	ID	UNIT NAME	NAME #	ID	UNIT NAME
1	_____	_____	33	_____	_____
2	_____	_____	34	_____	_____
3	_____	_____	35	_____	_____
4	_____	_____	36	_____	_____
5	_____	_____	37	_____	_____
6	_____	_____	38	_____	_____
7	_____	_____	39	_____	_____
8	_____	_____	40	_____	_____
9	_____	_____	41	_____	_____
10	_____	_____	42	_____	_____
11	_____	_____	43	_____	_____
12	_____	_____	44	_____	_____
13	_____	_____	45	_____	_____
14	_____	_____	46	_____	_____
15	_____	_____	47	_____	_____
16	_____	_____	48	_____	_____
17	_____	_____	49	_____	_____
18	_____	_____	50	_____	_____
19	_____	_____	51	_____	_____
20	_____	_____	52	_____	_____
21	_____	_____	53	_____	_____
22	_____	_____	54	_____	_____
23	_____	_____	55	_____	_____
24	_____	_____	56	_____	_____
25	_____	_____	57	_____	_____
26	_____	_____	58	_____	_____
27	_____	_____	59	_____	_____
28	_____	_____	60	_____	_____
29	_____	_____	61	_____	_____
30	_____	_____	62	_____	_____
31	_____	_____	63	_____	_____
32	_____	_____			

13.0 APPENDIX B

Option	Names
W269	Electronic Siren/PA
W290	Op Sel Coded Squelch
W452	MDC-600 ID & Emergency
W589	Public Address
W591	Auxiliary Switch Panel
W681	MDC-600 Selective Call
W688	Hidden Emergency Button
W711	Standard Mobile Voice Storage
W712	Extended Mobile Voice Storage
W824	MDC-600 Status
W825	MDC-600 Message
W873	Emergency Button on Control Head
W930	64 Mode Operation
W946	DTMF/Phone Interconnect

14.0 APPENDIX C

Control Head Button Map Positions

						MOTOROLA		
18	19	20	21	22	23	1	2	3
-----						4	5	6
						7	8	9
MODE VOLUME SEL HOME						RCL SQ' DEI		

"SYSTEMS 9000" BUTTON LIST

Standard SYSTEMS 9000 Control Head buttons shipped prior to JUNE 1987.

3880090J01 BLANK
J02 MPL
J03 Scan
J05 PA
J06 Siren
J07 Wail
J08 Hi-Lo
J09 Man
J10 H/L
J11 Sts
J12 Call
J13 Msg
J14 Rcl
J16 ExRd
J17 Del
J18 Sel
J20 DTMF
J21 Yelp
J22 MVS
J26 Emer
J28 F/R
J29 Alt
J31 Sql
J35 Pvt
J36 Site
J39 Home
J40 Menu
J41 Rpgm
J42 Step
J44 Phone
J45 Dir
J49 0
J50 L/S
J51 S/S
J52 Emer
J58 AirHn
J61 Srch
J62 Lock
J63 Page

3880253K01 PLUG

Continued Next Page

Continued SYSTEMS 9000 Buttons

Standard "Systems 9000" Control Head buttons shipped on units after JUNE 1987. Selected buttons have bold graphics compared to prior JUNE 87 buttons.

3880043M01 BLANK

M02 MPL
M03 Scan
M05 PA
M06 Sirn
M07 Wail
M08 Hi-Lo
M09 Man
M10 H/L
M11 Sts
M12 Call
M13 Msg
M14 Rcl
M16 ExRd
M17 Del
M18 Sel
M20 DTMF
M21 Yelp
M22 MVS
M26 Emer
M27 Ext
M28 F/R
M29 Alt
M31 Sql
M35 Pvt
M36 Site
M39 Home
M40 Menu
M41 Rpgm
M42 Step
M44 Phon
M45 Dir
M49 0
M50 L/S
M51 S/S
M52 Emer
M58 AirHn
M61 Srch
M62 Lock
M63 Page

3880253K01 PLUG

Continued Next Page

Mode & Volume Rocker Button List

3880091J07	BOLD GRAPHICS	SYS
J06	BOLD GRAPHICS	SUB
J05	STD GRAPHICS	Zone
J04	BOLD GRAPHICS	Vol
J03	BOLD GRAPHICS	Mode
J02	STD GRAPHICS	Volume
J01	STD GRAPHICS	Mode

Direct Entry Keyboard buttons

3880156L01	BLANK
L02	MSG 1
L03	MSG 2
L04	MSG 3
L05	MSG 4
L06	MSG 5
L07	MSG 6
L08	MSG 7
L09	MSG 8
L18	STS 1
L19	STS 2
L20	STS 3
L21	STS 4
L22	STS 5
L23	STS 6
L24	STS 7
L25	STS 8
L34	Siren
L35	PA
L36	Yelp
L37	Wail
L38	Hi-Lo
L39	Man
L40	ExRd
L41	ArHn

SECURENET Digital Capable SYNTOR X 9000 Option Table

MODEL/ OPTION	DESCRIPTION	INCOMPATIBLE OPTIONS
T99KX036W	SX 9000 HB 40W	W123,W124
T99KX037W	SX 9000 HB 100W	W123,W124
T99KX038W	SX 9000 UHF 30W	W544,W577,W578
T99KX039W	SX 9000 UHF 78W	W555,W577,W578
T99KX040W	SX 9000 UHF 100W	W123,W124,W544,W577,W578

W988	LIMITED CONTROL HEAD	ALL OPTIONS NOT MARKED (+)
W844(+)	PLANT PROGRAMMING	
W425	REPEATER TALK AROUND	W90
W930	64 MODE OPERATION	W983,W984
W290	OPERATOR SELECT MPL	W90

"CHANNEL SCAN" MONITORING

W495	MODE SELECT SCAN	W90,W929
W421	TWO LEVEL PRIORITY	W90,W929
W703	TALK BACK SCAN	W90,W929
W929	OMIT SCAN	W90,W421,W495,W703

W946	DTMF/TELE INTERCONNECT	
W116	EXTERNAL ALARM	W90,W681

"MDC-600" SIGNALLING

W452	UNIT ID AND EMERGENCY ALERT	W20*,W90,W712,W681,W824,W825,W983,W984
W681	SELECTIVE CALL ENCODE/DECODE	W20*,W90,W452,W116
W824	STATUS	W20*,W90,W452,W983
W825	MESSAGE	W20*,W90,W452,W984
W873	EMER BUTTON CONTROL HEAD	W90
W688	EMER HIDDEN BUTTON	W90,W470
W470	EMER HIDDEN FOOT SWITCH	W90,W688
W983	DIRECT ENTRY STATUS	W20*,W90,W452,W984,W824,W930
W984	DIRECT ENTRY STATUS/MESG	W20*,W90,W452,W983,W825,W930
W712	MOBILE VOICE STORAGE	W20*,W90,W452
W269	SIREN/PA	W90,W589,W125
W589	PA	W90,W269,W125
W591(+)	AUXILIARY SWITCH PANEL	W90

INTERNAL OPTIONS

W12(+)	RF PREAMPLIFIER	
W11(+)	TIME-OUT TIMER	W428
W428	VARIABLE T-O-T	W11
W427	AND SQUELCH	

OPTION	DESCRIPTION	INCOMPATIBLE OPTION
EXTERNAL OPTIONS		
W20(+)	DTMF MICROPHONE	W71, W90, W109, W239
W109(+)	HANDSET	W20, W239, W90, W71
W239(+)	NOISE CANCEL MIC	W20, W109, W90, W71
W71(+)	OMIT MICROPHONE	W20, W109, W90, W239
W496	10FT. CABLE	W90, W101, W674, W391, W78
W101	22FT. CABLE	W90, W496, W674, W391, W78
W87(+)	OMIT SPEAKER	W90
W544(+)	VHF BASE LOADED ROOFTOP ANT.	W70, W90, W578, W577, W123, W124
W578(+)	VHF COAXIAL SIDE MOUNT ANT.	W70, W90, W544, W577, W123, W124
W577(+)	VHF COAXIAL BUMPER MOUNT ANT.	W70, W90, W544, W578, W123, W124
W123(+)	UHF 3.5 DB GAIN ANTENNA	W70, W90, W544, W578, W577, W124
W124(+)	UHF 5 DB GAIN ANTENNA	W70, W90, W544, W578, W577, W123
W70	OMIT VHF ANTENNA	W90, W544, W578, W577, W123, W124
W90	OMIT ALL ACCESSORIES	ALL OPTIONS EXTERNAL TO RADIO
W125**	OPTION EXPANSION INTERFACE KIT	W90, W269, W589

"SECURENET" SYSTEM

W388	DES	W794, W797, W795, W303
W795	DES-XL	W388, W794, W797, W303
W794	DVP	W388, W797, W795, W391
W797	DVP-XL	W388, W794, W795, W303
W391	PHYSICAL SECURITY	W101, W794
W268	CODE STORAGE	
W304	PROPER CODE DETECT	
W303	DUAL CODE SELECT	W797, W388, W795
W674	PHYSICAL SECURITY CABLING	W794, W101
W78	ALTERNATE LENGTH SEC CABLING	W794, W101

* CONTACT YOUR ASE FOR COMPATIBILITY

** THIS OPTION IS REQUIRED WHEN ORDERING MORE THAN 2 "SYSTEMS 9000" OPTIONS WHICH REQUIRE OPTION BOARDS. OPTION EXPANSION INTERFACE KIT IS NOT REQUIRED IF SIREN/PA IS ORDERED.

THE FOLLOWING OPTIONS REQUIRE OPTION BOARDS:

1. MDC-600 SEL CALL (W681) OR PTT ID & EMERGENCY (W452)
2. ANY STATUS / MESSAGE OPTION (UNLESS W452 OR W681 IS ORDERED)
3. DTMF / TELEPHONE INTERCONNECT (W946)
4. MOBILE VOICE STORAGE (W712)
5. ANY SECURITY ENCRYPTION OPTION (UNLESS W391 IS ORDERED)

THE FOLLOWING COMBINATION OF OPTIONS CANNOT BE ORDERED DUE TO THE LIMITED SPACE ON THE CONTROL HEAD INDICATOR PANEL:

W425 REPEATER TALK AROUND
W290 MULTIPLE CODED SQUELCH
W269 SIREN / PA
W946 DTMF / TEL INTERCONNECT
ANY SECURITY ENCRYPTION OPTION

SECTION 2.0

SMARTNET System

SECURENET Digital Capable

"SYNTOR X 9000E" TRUNKED/CONVENTIONAL MOBILE RADIO Operation

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GENERAL FEATURES

TRUNKED AND CONVENTIONAL OPERATION

This enhanced dual mode SMARTNET radio is designed to operate in both trunked and conventional 800 MHz radio systems. The standard radio includes 8 systems, 8 subfleets, and 64 conventional modes. Options are available to expand the capabilities up to a total of 248 trunked and conventional modes to accommodate the requirements of large state-wide systems.

The trunked and conventional capabilities of this radio provide the user with a much wider coverage area. The ability to communicate on conventional channels when out of reach of the trunking system adds an enormous amount of operational efficiency.

"SECURENET" ENCRYPTION CAPABILITY

The SYNTOR X 9000E radio offers the optional capability of secure trunking. Both DVP and DES encryption options are available.

The concept of secure trunking opens a tremendous amount of new opportunities in interagency communications. Widely separated agencies can reap the benefits of operating on a common SYNTOR X 9000E SMARTNET trunking system without eliminating those members that require SECURENET encryption capabilities.

EXPANDED DUAL MODE CAPABILITY

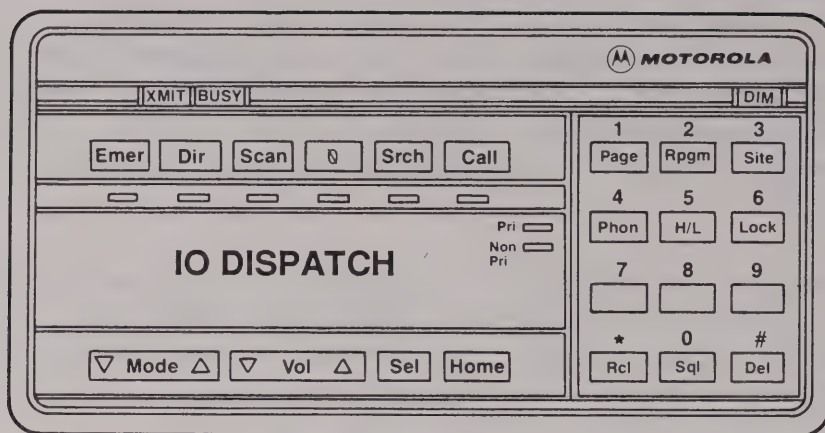
System flexibility is the middle name of this exciting new mobile radio due to the broad array of both trunked and conventional features that are available in a single radio.

This powerful systems radio furnishes features and optional capabilities regardless of whether operating in a trunked or conventional mode.

EASY TO OPERATE

User friendly operation is a direct result of the clearly marked and easy to operate controls.

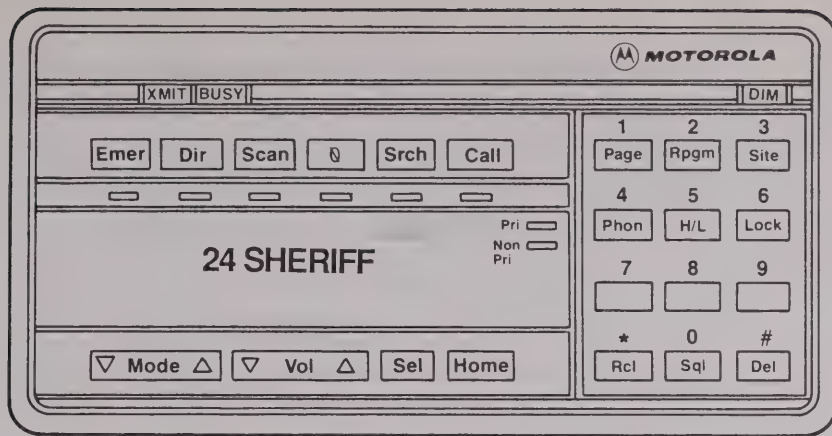
The wide selection of functions and options are all activated quickly and easily due to their uniformity of operation. Similar trunked and conventional options, such as telephone interconnect or status/message are initiated the same way due to the true dual mode capabilities of the SYNTOR X 9000E mobile radio.



CONTROL UNIT

All SYNTOR X 9000E radios come standard with the same size control unit measuring 6.5" by 3.4" by 1.7". This style of control head is referred to as SYSTEMS 9000. The SYSTEMS 9000 Control Head was designed to accommodate the lack of mounting space available in today's smaller vehicles. Multiple options have become a necessity in modern communication systems and SYSTEMS 9000 design has met the challenge. Nearly all of the features and options are controlled from a single compact control unit. The only exceptions are Siren, Auxiliary Switch Panel and Status/Message which, for the convenience of the user, are included in a supplemental housing that mounts directly above the control unit.

Many agencies are selecting smaller vehicles for their fleets due to the high cost of operating a large car. They have found that in many cases there simply wasn't enough room to install a sophisticated radio system and also provide room for the driver, let alone a passenger. They have solved this problem by selecting the SYNTOR X 9000 or 9000E radio which allows them to add the options they need without requiring additional mounting space.



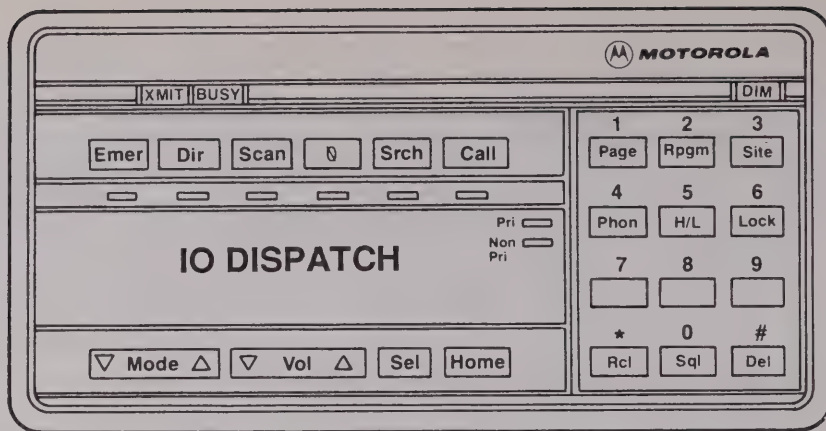
11-CHARACTER ALPHANUMERIC DISPLAY

The Control Unit's ability to display names adds a visual dimension to mobile communications. It allows the user to assign a meaningful name to each operating condition. These names are field programmable and can be changed as often as required.

The SYSTEMS 9000 Control Unit utilizes an eleven-character, vacuum fluorescent, fourteen-segment display for high definition. This design is less susceptible to the affects of wash-out which is a common problem with the traditional LED types of displays.

This electronic directory eliminates the double checking involved when selecting a specific trunked or conventional talkgroup. It also makes it easy to remember a telephone or Private Conversation number since all that is needed is to look for the desired name.

Imagine a Public Safety officer with a 32-mode radio in his vehicle trying to remember what mode the sheriff is operating on. What could be easier than [24 SHERIFF]?



DAY OR NIGHT VISIBILITY

The SYSTEMS 9000 Control Unit provides optimum visibility as a result of its back lit control buttons and channel display. In addition, a Dimmer Control allows the operator to adjust the brightness level depending on ambient light conditions. Four distinct light levels are available including high, medium, low, and off.

This flexibility allows the operator to adjust for bright sunlight conditions or even eliminate all lighting for surveillance applications.

MIL STD 810-D ENVIRONMENTAL PROTECTION

The environmental protection of MIL STD 810-D means both the radio and control unit can survive the most demanding mobile surroundings.

SYNTOR X 9000E radio provides an extra margin of ruggedness for radios used in harsh environments. Dusty construction sites, exposed oil field services and demanding Public Safety users all require a mobile radio that is dependable no matter how tough the conditions are.

The SYNTOR X 9000E radio was designed to meet these types of rugged working conditions and continue operating with true, quality performance.

The radio and the Control Unit will survive the following tests:

MIL 810-D

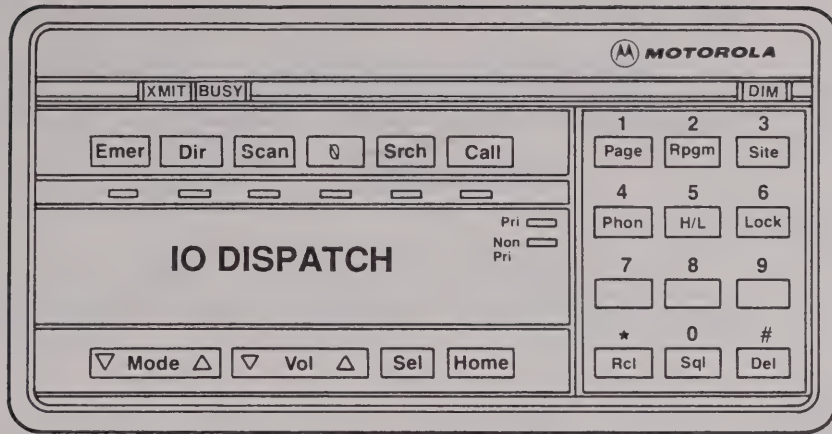
Rain: 4 inches an hour with a 40 mph wind for two hours, Method 506.2 Procedure 1.

Sand Dust: 28 hours with wind-driven fine sand dust, Method 510.2 Procedure 1.

Salt: 48 hours in corrosive salt fog over a wide range of temperatures and humidity, Method 509.2 Procedure 1.

Shock: While mounted, passes a 30 g shock on all six sides, Method 516.3 Procedure 1.

Vibration: Survives vibration frequencies from 5 to 500 Hz, Method 514.3 Category 8 Figures 514.3-35 & 514.3-36.



SIMPLIFIED INSTALLATION

The SYSTEMS 9000 power cable is 17 ft. in length (standard), under 3/8ths of an inch in diameter, negative ground, 14-conductor, and terminates into a specially designed over-molded connector to ensure easy installation and provide increased reliability.

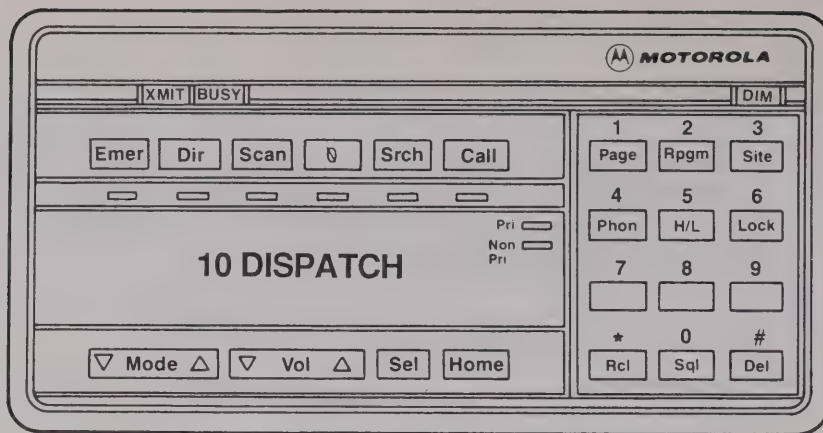
Routing a power cable from the radio to the control unit usually requires the installer to disconnect all of the exposed wire from their connectors, tape them together for protection, pull the cable under the vehicle's carpet and then re-connect all the wires back into their respective connectors. The SYSTEMS 9000 power cable with it's smaller diameter unique over-molded connector reduces installation time and eliminates the possibility of loose or incorrectly placed wires.

UNIQUE "D" CONNECTOR

This type of Control Unit connector not only facilitates installation but provides strain relief to the microphone and control cables by snapping into the control housing itself. Additional strain relief is provided by the traditional "S" hook. No strain or fatigue is placed on the internal PC board.

CONNECTOR PINS

All interconnect pins are gold plated in the SYNTOR X 9000E radio and Control Unit. This provides increased reliability in normal environments as well as in those that have dirt, dust or other corrosive elements present. Gold plating resists corrosion much better than tin which is typically found in many competitive radios.



PROTECTED POWER AMPLIFIER

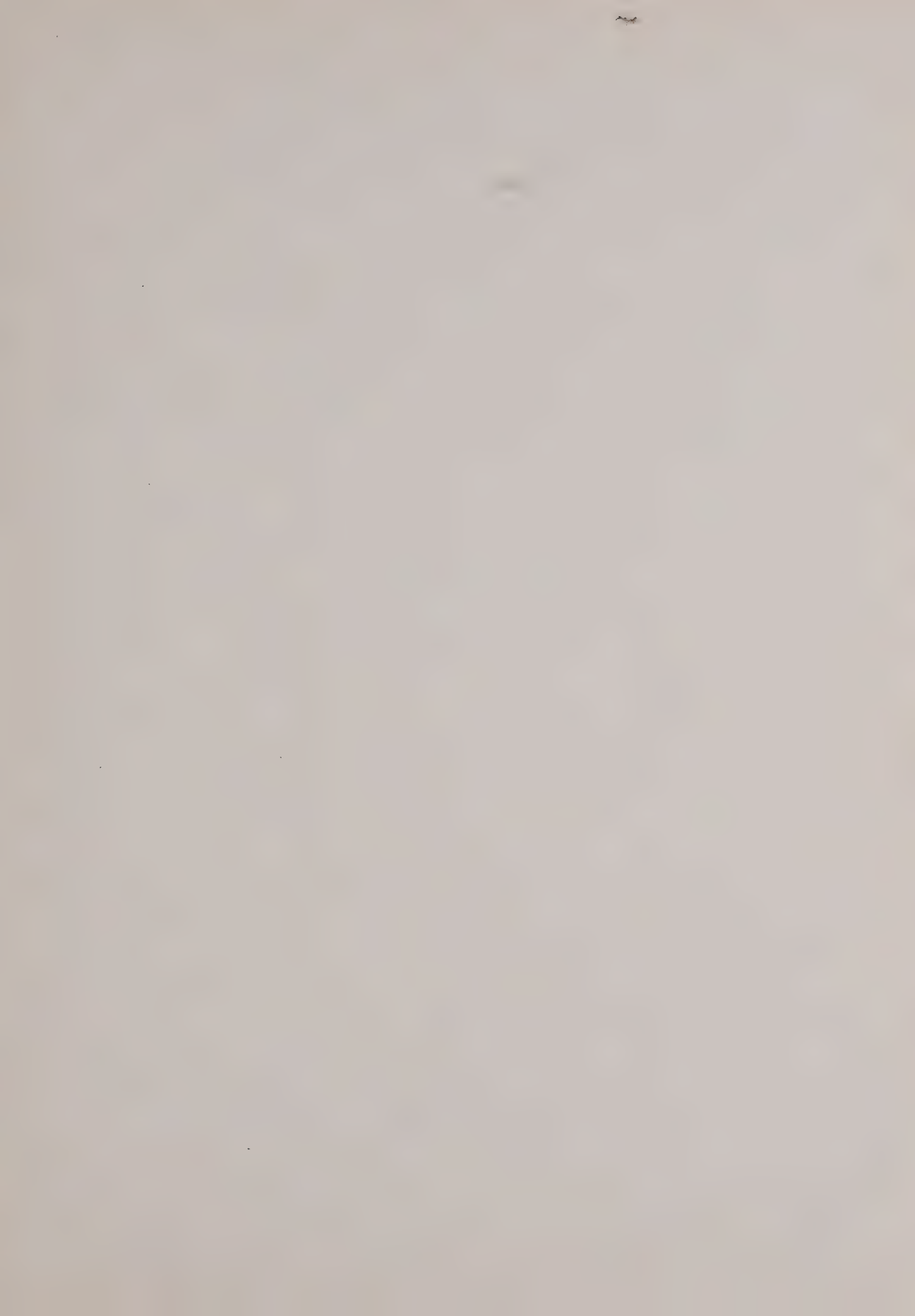
The SYNTOR X 9000E radio provides a power cutback circuit and ruggedized transistors. This protects the radio's power amplifier from accidental heat damage which could cause a failure, reduced performance or shorten the life of the PA.

A common cause of heat build-up is damaged antennas, antenna connectors and antenna cables.

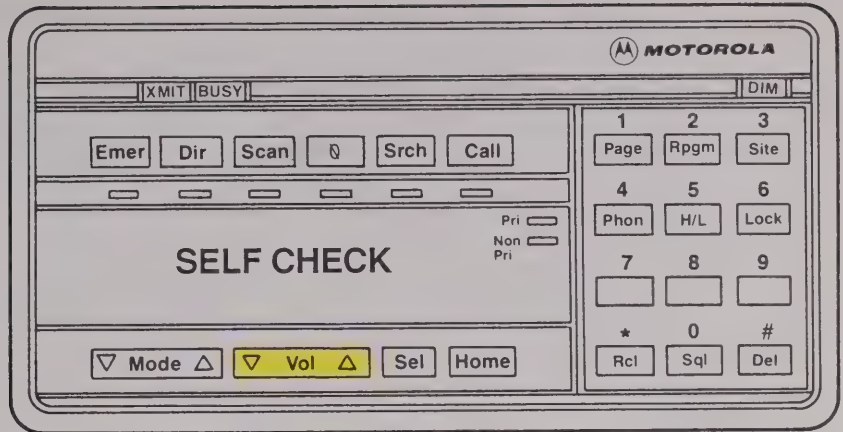
FIELD OPTION EXPANSION

The SYNTOR X 9000E radio makes it extremely easy for customers to add options in the field to meet their changing communication needs. All options can be added in the field by either reprogramming the Control Unit or in some cases adding a snap-in option board to the radio, a button to the Control Unit, and reprogram the system to enable the option.

A specific example could be adding the MDC-1200 Selective Call option in the field. Simply order the option and interconnect cable from the 1.1 Section of the price book, snap the board into the radio and plug in the cable (no soldering is required), plug the "Call" button into the Control Unit, and reprogram the system to enable the option.



STANDARD FEATURES



OFF/ON SWITCH

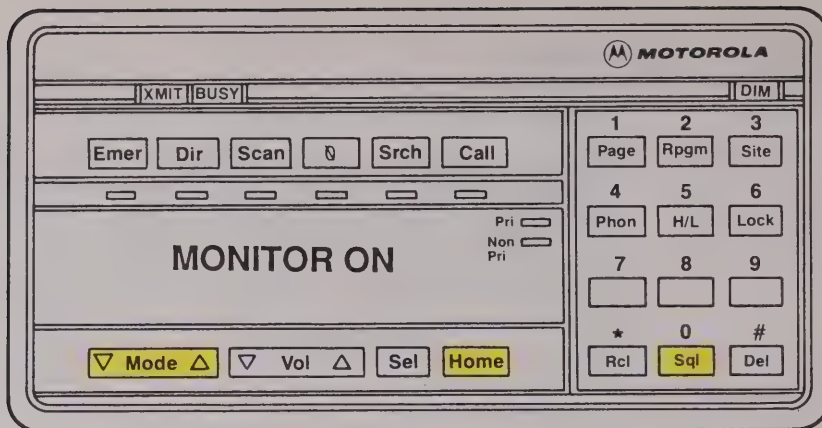
The power switch is a hidden slide switch located on the bottom right side of the Control Unit. This placement helps to prevent accidental turn-offs. Sliding the switch to the left turns the radio on. When powered up, "SELF CHECK" displays and the radio checks itself for proper operation. If a system malfunction is discovered, an error code displays for two seconds. Should the failure prevent the radio from, as an example, talk and listen operation, the Control Unit stops accepting inputs and a fail code displays. These types of malfunctions may or may not prevent the use of the radio (dependent on user programming). In either case see the service department.

VOLUME

The **[Vol]** rocker switch controls audio volume levels for radio reception. Separate from this, it also sets the public address and external radio volume when these options are selected. For more on this function see **SIREN/PUBLIC ADDRESS**.

To set the volume, simply press the rocker switch's right side to increase audio output or left side to decrease. When pressed, a numerical value 0 through 15 displays to represent the level of output. The level setting is held in memory so turning the radio off and on will not effect the last selection.

If power is lost to the radio, the volume level will return to a factory set or field programmed default level of volume. This setting also determines the minimum volume level of the audible alert tones heard when changing modes, receiving an individual page and selective calls, etc..



SQUELCH

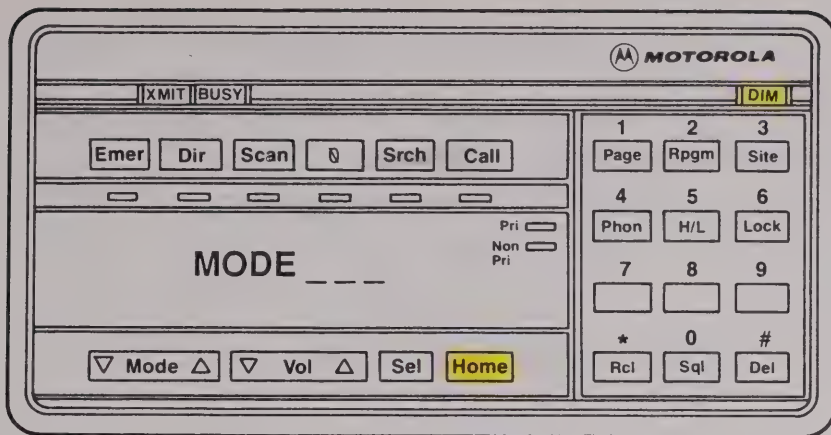
The **[Sql]** button provides two functions. One, it enables and disables the tone-coded squelch separate from the microphone hang-up function. And two, it allows squelch level setting.

When the radio is turned on, the coded squelch will return to the last condition it was in, (enabled or disabled). To enable or disable, press the **[Sql]** button to display either "MONITOR OFF" or "MONITOR ON". The display condition is momentary and reverts back to the currently selected mode name. Taking the microphone off and on hook provides the same function with no display.

To set the squelch level, hold **[Sql]** until a beep sounds. The display shows the current setting 0 through 4; (0 - being unsquelched, 1 - representing the threshold, and 4 - being tight squelched). Pressing **[Mode]** up or down changes the setting. Press **[Home]** to return to the currently selected mode name. If power is lost to the radio, the squelch level will return to a field programmed default level of squelch.

MODE ROCKER SWITCH

Use the **[Mode]** rocker switch to scroll through the list of programmed modes in the radio. During normal operation, the selected field programmed mode name is shown on the radio's display. When the radio is turned on, the mode last selected is displayed. When the mode switch is pressed, a field programmable alert tone is produced to indicate the mode has changed. **[Mode]** is also used in the configuration state as a function in selecting option choices.



HOME

The radio will change to a preprogrammed home mode when **[Home]** is pressed. This is a direct access of mode, regardless of the number of modes between the programmed Home and previously displayed mode.

Rather than scrolling to a desired mode, a direct access may be taken by holding down the **[Home]** button until an audible alert tone is heard. The display will read "MODE_ _ _". From the keypad enter the desired mode number. Press **[Home]** and the selected mode is now displayed.

DIMMER

The **[DIM]** button adjusts the brightness of the display to one of four levels. When the radio is turned on, the brightness automatically resets to its highest level. Press **[DIM]** to lower the brightness setting. The lowest setting turns the display, backlit buttons and even the transmit indicator off for surveillance operation. The surveillance level can be disabled through field programming. Pressing the **[DIM]** button one more time returns the brightness to its highest level again.

PUSH-TO-TALK INHIBIT

This field programmable feature will inhibit operator PTT on a selected mode. This can be used for "data-only" channels or for programmable mode lock out.

INVALID TRANSMIT MODE ALERT TONE

By enabling this field programmable feature an alert tone will sound when the operator attempts to transmit on a mode that, for example, is PTT Inhibited.

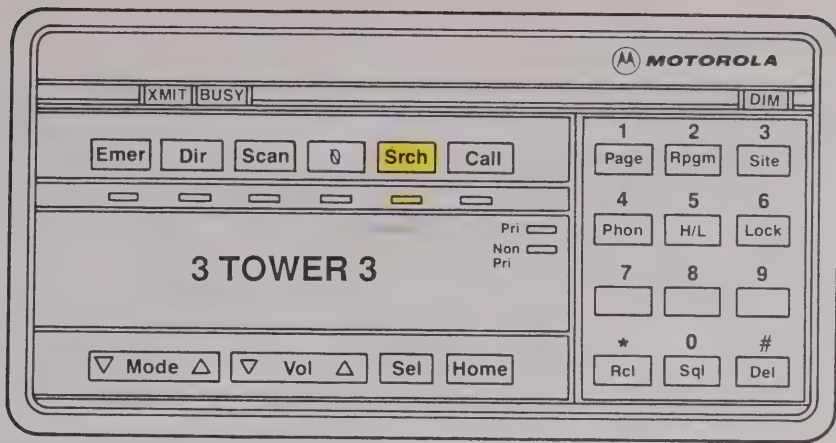
IGNITION SENSE FOR TRANSMITTER

This is a field programmable feature that allows the customer to select one of two conditions when the ignition switch is off.

These conditions are:

1. All transmissions are uninhibited.
2. Push-to-talk is inhibited.

Note: This feature is not valid if Orange and Green leads are tied to 'HOT'.



SYSTEM SEARCH AND LOCK

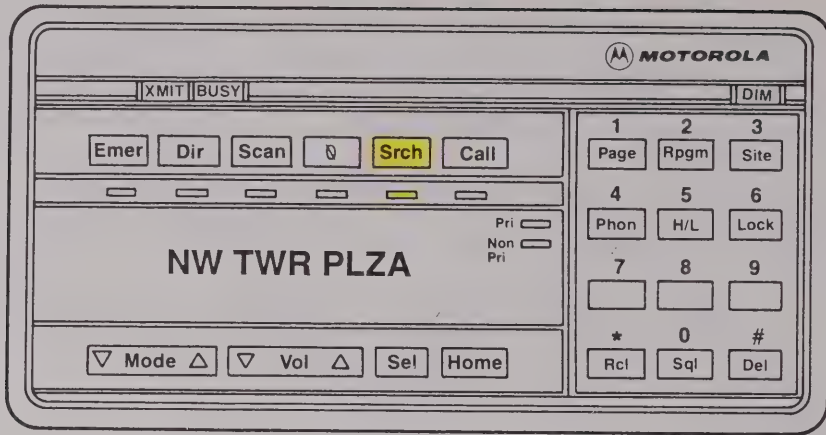
Some systems require their mobile units to travel in and out of range of several conventional and/or trunked repeaters. System Search and Lock, as a standard feature, will keep the vehicles in communications by following the paths of these repeaters.

When a vehicle moves out of range of a repeater, the radio will automatically search through a predetermined list of potential replacements and lock on to a system that is in the coverage area. The search list can include a combination of up to 10 trunked/conventional repeater systems. Each radio can have up to 25 different search lists which are activated on a per mode basis. The conventional repeater must be modified to accommodate System Search and Lock. The trunking fixed end can be either a SMARTNET or a PRIVACY PLUS system.

An example of this feature would be the following application:

The mobile operator is currently on a conventional mode. The mobile moves out of range of this system into the coverage area of a trunked system. The radio having this system in the search list will take six seconds to lock on to the control channel. The radio has a Look Back Timer set at a variable field programmable or factory set default time of two minutes, which will direct the mobile on a timed basis to "Look Back" to the selected mode to see if it is within range.

Had the mobile moved within range of a conventional repeater, locking on would have taken only one second. This is accomplished through a non-operator initiated DPL handshake code. While locked on to a conventional mode, certainty of coverage is accomplished by a Interrogation Timer which sends this DPL handshake code in variable field programmable or factory set one minute time increments.



OPERATING INSTRUCTIONS

Press the [**Srch**] button to turn the function on. While the radio is searching for a new repeater, the indicator light below the button will flash. Once a new site has been found, the new mode name/number appears on the display and the indicator lights solid.

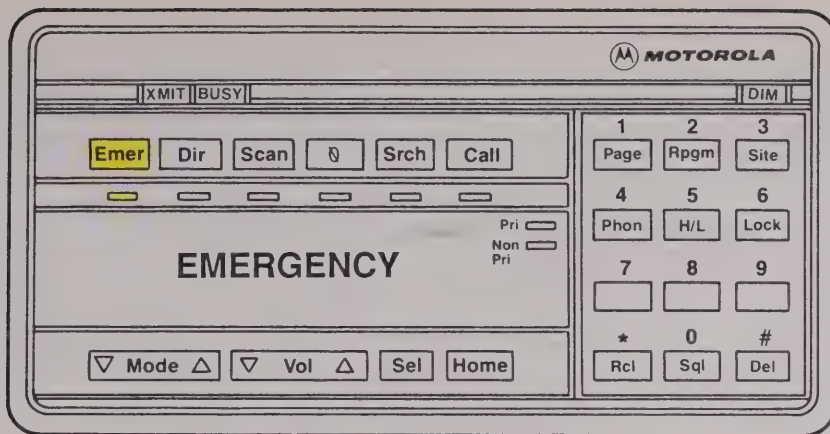
Pressing the button again will turn the function off and the display will return to the originally selected mode.

There can be situations where the mobile operator is in a fringe area that overlaps other systems and knows that signal strength or coverage can be enhanced by switching antenna sites. Therefore, to manually initiate a system search, press the [**Srch**] and hold it down until a (beep) sounds. The operator has forced the radio to search for another site.

PUSH-TO-TALK ID (Trunking)

Some SMARTNET features require no special attention on the part of the operator. For instance, every time the radio operator keys the microphone, the unit's ID number is transmitted. Besides giving the dispatcher immediate information about the source of the call, a permanent record can be kept on all conversations.

NOTE: Requires properly equipped Central Controller.



EMERGENCY OPERATION (Trunking)

Since system busy signals cannot be tolerated in emergency situations, the Emergency Call and Alarm feature allows the operator to have priority channel access during life threatening events. Emergency Operation is available in several different variations.

Emergency Call

* OPERATING INSTRUCTIONS

To activate the Emergency Call feature, press the **[Emer]** button. The red indicator will light and the display will flash "EMERGENCY".

Pressing the microphone PTT button for a voice channel assignment when all channels are assigned, will initiate the Emergency Call as defined by the System Manager based on:

- A. Ruthless Pre-emption; a channel is immediately taken from a current user.
- B. Top-of-Queue: a channel becomes available upon the first de-key of a current user.

After completing the Emergency Call, press and hold the **[Emer]** button until an alert tone (beep) sounds and the red indicator turns off.

Emergency Alarm

* OPERATING INSTRUCTIONS

To activate the Emergency Alarm Feature, press the **[Emer]** button. The red indicator will light and the display will flash "EMERGENCY" while the alarm is being sent in on the Control Channel.

The operator will hear a central acknowledgment tone (beep) indication the alarm has been received by the System Central Controller. A dispatch acknowledgment tone (4 beeps) follows, and the radio will automatically return to normal operations.

Silent Emergency Alarm

*** OPERATING INSTRUCTIONS**

During a Silent Emergency Alarm, the indicator below the **[Emer]** button will not light and the receiver audio is muted so that no indication is given that an Emergency Alarm has been sent.

To activate the Silent Alarm, press the **[Emer]** button. The Silent Alarm mode will exit when the microphone PTT is pressed or when the **[Emer]** button is pressed and held until an alert tone (beep) is heard.

Emergency Call and Alarm Combination

If the radio is equipped with both Emergency Call and Alarm features, it automatically proceeds to the call mode after the alarm is acknowledged.

To activate the Emergency Call / Alarm feature, press the **[Emer]** button. The red indicator lights and the display flashes "EMERGENCY" while the alarm is being sent.

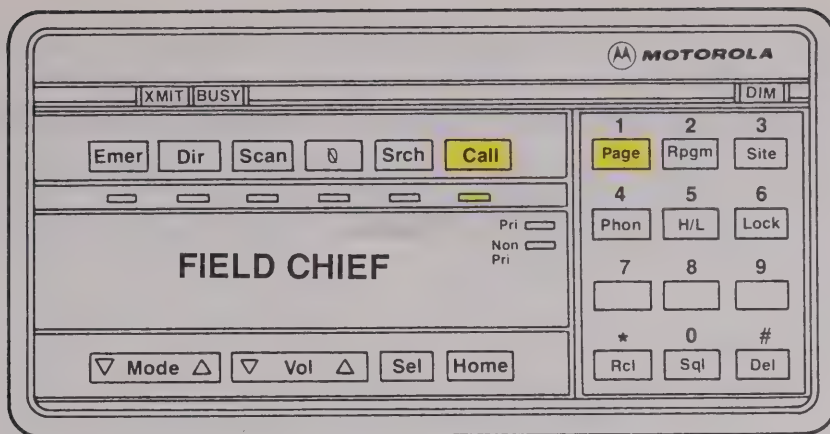
The operator then hears a central acknowledgment tone (beep) indicating that the alarm has been received by the System Central Controller. A dispatcher acknowledgment tone (4 beeps) follows and the display continues to flash "EMERGENCY".

Pressing the microphone PTT button will initiate the Emergency Call as defined by the System Manager. (i.e., Ruthless Pre-emption, Top of Queue, etc.)

If the Silent Emergency Alarm is used with Emergency Call, pressing the microphone PTT will discontinue the silent mode.

After completing the Emergency Call, press and hold the **[Emer]** button until an alert tone (beep) is heard and the red indicator is turned off.

Note: If the radio is equipped with a hidden footswitch or pushbutton, it will perform the same function as the **[Emer]** button.



MULTIPLE "PRIVATE CONVERSATION" CALL / "CALL ALERT" PAGE CAPABILITY (Trunking)

This feature allows the operator to page (Call Alert) and hold Private Conversation calls with up to nine predetermined units. This list of nine frequently called units can, with field programming, include name in addition to a unit ID number for each target unit.

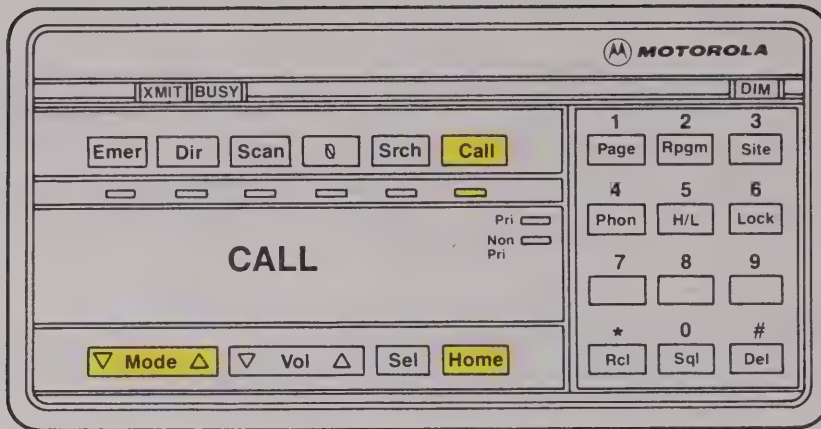
The Control Unit provides a visual and audio signal that a page has been received. In addition, the page can activate optional external horn and light alarms (W116) to alert operators that are away from their vehicle.

When sending a page (Call Alert) to another unit, the sender receives an acknowledgment providing positive feedback that the transmission has been received and an alert signal has been generated.

The ability to receive selected calls and respond to specific units provides unit-to-unit privacy for conversations dealing with sensitive issues.

Note: For Unlimited Private Conversation call / Call Alert page capability see the (W820) option.

- * Initiating a Private Conversation call
 - * To receive a Private Conversation call
 - * Initiating a Call Alert page
 - * To receive a Call Alert page
 - * Storing call and page ID numbers in memory
- continued next page



Initiating a "Private Conversation" Call

* OPERATING INSTRUCTIONS

To initiate a Private Conversation call, the operator presses the **[Call]** button. An alert tone (beep) will be heard and the red indicator light will blink. The display shows the last ID called. Use the **[Mode]** rocker to scroll through the prestored list of names and their associated ID numbers.

Once the desired ID number / name is selected, the call may be initiated by pressing the microphone PTT button. Pause for a second to allow the alert tone to be heard by the receiving unit and then begin the conversation.

After completing the Private Conversation call, press the **[Home]** button to return the radio to normal operation.

To Receive a "Private Conversation" Call

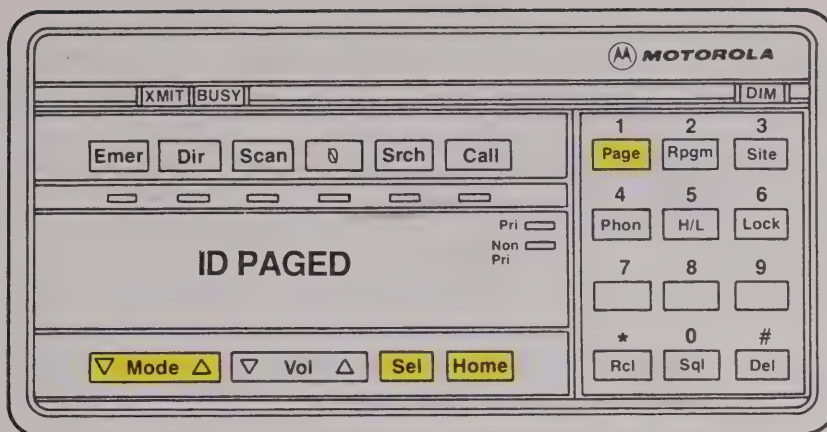
* OPERATING INSTRUCTIONS

When a Private Conversation call is received, the operator will hear two alert tones (beep-beep) and the display shows "CALL".

The call is answered by pressing the **[Call]** button. The operator will hear an alert tone (beep) and the red indicator light begins to blink. The display then changes to "ID RCVD". The operator may now respond to the call by pressing the microphone PTT.

After completing the Private Conversation call, press the **[Home]** button to return the radio to normal operation.

Note: If the radio is equipped with Horn and Light Alarms, see the W116 External Alarms section.



Initiating a "Call Alert" Page

*OPERATING INSTRUCTIONS

To initiate a Call Alert page, the operator presses the **[Page]** button. An alert tone (beep) will be heard and the display will show the last ID paged. Use the **[Mode]** rocker switch to scroll through the prestored list of names and their associated ID numbers.

Once the desired unit has been selected, the page is initiated by pressing the **[Sel]** button. The display shows "PLEASE WAIT" while the Page is being processed.

When the mobile unit being paged receives the signal, an acknowledgment is sent back to the initiating unit. Then the operator hears four alert tones (beeps) and the display shows "ID PAGED". The radio immediately reverts back to the normal operating mode.

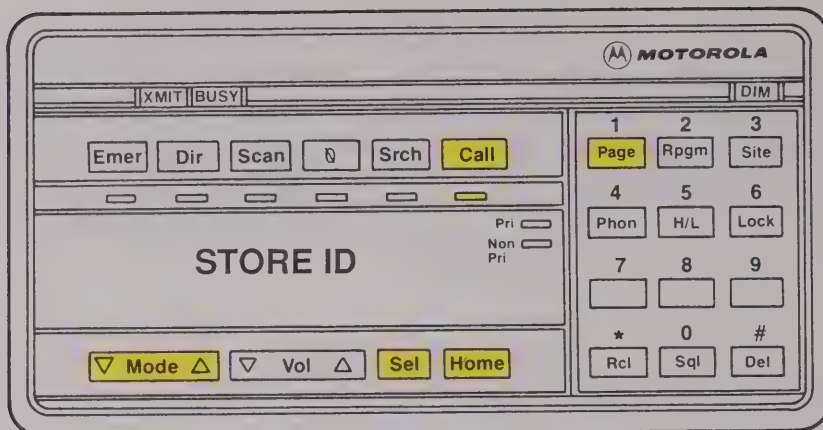
If the acknowledgment is not received within three to five seconds after the page has been transmitted, the display shows "PAGE NO ACK". Press the **[Home]** button to return the radio to normal operation.

To Receive a "Call Alert" Page

*OPERATING INSTRUCTIONS

When a Call Alert page is received, the operator hears four alert tones (beeps) and the display flashes "PAGE". This sequence is repeated periodically until the operator answers the page by pressing the microphone PTT button.

NOTE: If the radio is equipped with Horn and Light Alarms, see the W116 External Alarms section.



Storing Call or Page ID Numbers in Memory

* OPERATING INSTRUCTIONS

To store call or page IDs in memory, first press the **[Call]** or **[Page]** button. An alert tone (beep) sounds and the red indicator blinks. The display then shows the last ID called.

Use the **[Mode]** rocker to scroll to "STORE ID" and then press the **[Sel]** button. The display then changes to "UNIT 1", "UNIT 2", etc. (call and page names can be field programmed)

If the call or page name is left on the display for more than two seconds, the display changes to the ID number currently stored in that location. Left alone, the display alternates between the name and ID number every two seconds. This allows the operator to review the ID number before changing it.

When the desired memory location is displayed, use the keypad to enter the ID number to be stored.

After the ID has been entered, press the **[Sel]** button to store it in memory and continue making other changes or press the **[Home]** button to store it and return to normal operation.

OPERATOR SELECT "CHANNEL SCAN" MONITOR (Trunked and Conventional)

This feature greatly enhances talk group monitoring capability. It allows the operator to select and adjust a scan list to best serve individual requirements.

Channel Scan monitoring allows the mobile operator to monitor a previously defined list of trunked or conventional modes for activity. If no activity exists, the display shows the selected mode. When a scanned mode becomes active, the display shows the mode number/name and unmutes the radio. A scan list cannot include both trunked and conventional modes.

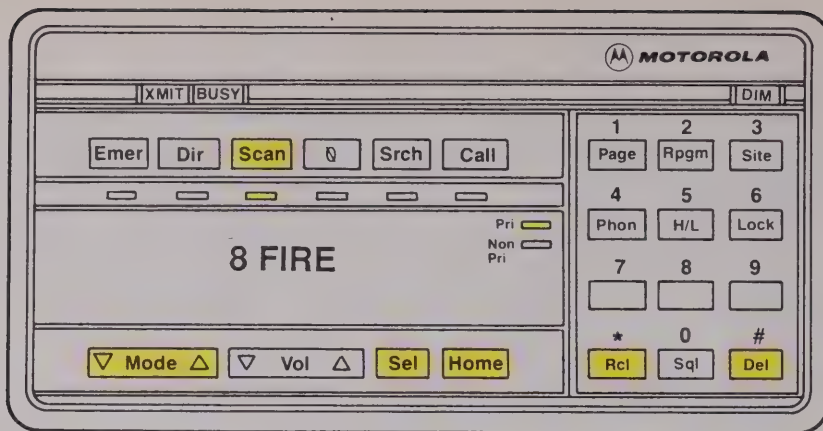
The conventional scan list can consist of up to 16 channels plus the selected mode. One conventional scan list is allowed per radio. The trunked scan monitors up to 8 talk groups plus the selected mode. One scan list is allowed per trunked system.

The scan list will always include the selected mode. This avoids the possibility of the operator not including the selected mode in the scan list.

The SYNTOR X 9000E radio was designed to have both trunked and conventional scan operate in much the same fashion. In a trunked mode the radio only scans subfleets, within a fleet or across fleets. It does not scan systems! When a trunked scan list includes priority subfleets, we call this "TRUNKED PRIORITY MONITORING". This feature requires the proper fixed end equipment. When no activity is present, the radio is monitoring the control channel high speed data for activity in its scan list. If a nonpriority channel becomes active, the radio will go to that voice channel for the duration of the conversation, leaving only if sensing priority activity through the subaudible low speed data being received on that voice channel.

In addition to the obvious flexibility of this feature, it is also very simple to use. The ability to display a meaningful name for each mode allows instant recognition of an active channel by the operator.

- | | |
|----------------------------|--------------------|
| * Operator Selectable Scan | * Talk Back Scan |
| * Dynamic Priority | * Scan Hang Times |
| * Two Level Priority | * Scan Enable |
| * Priority Alert Tone | * Scan Squelch |
| * Nuisance Mode Delete | * Mode Slaved Scan |



Operator Selectable Scan

* OPERATING INSTRUCTIONS [Scan]

Scan is turned on and off by pressing the **[Scan]** button. When the scan is on, the red indicator below the button will be lit and the previously selected scan list is enabled.

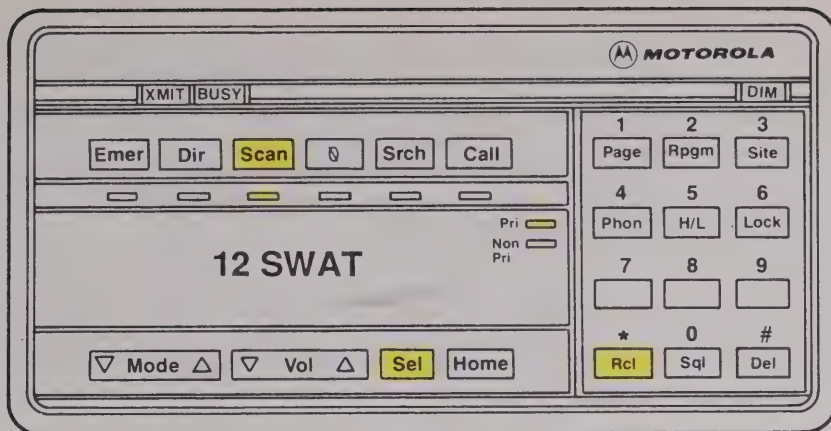
To enter a list, modify or review the existing scan list, press the **[Scan]** button and hold it until an alert tone is heard and the red indicator light begins to flash. Now a new scan list can be entered by either selecting a mode number using the keypad or by using the **[Mode]** rocker to locate a mode name. Either or both priority and non-priority modes may be selectable, depending on how the radio EEPROM is programmed. Once the desired mode name appears on the display, it can be added to the list as a non-priority mode by pressing the **[Sel]** button once, a second priority by pressing the **[Sel]** button twice or as the first priority by pressing the **[Sel]** button three times.

Press [Sel]	Assigns Mode To	Indicator
1 Time	Non-Priority	Non-Priority Lights
2 Times	Second Priority	Priority Lights
3 Times	First Priority	Priority Flashes

Modes may be removed from the list by selecting the undesired mode through keypad entry or mode rocker and then pressing the delete **[Del]** button.

To review the selected list the recall **[Rcl]** button is pressed and held down to scroll through the current scan list. As each mode in the scan list is displayed, its priority will be indicated by the priority and non-priority indicators on the display.

Once scan modifications are complete, pressing the **[Home]** button will exit the scan list entry mode and scan will turn on.



TWO-LEVEL PRIORITY

This field programmable feature adds a second level of priority (P2) to a designated channel in the scan list. If activity exists on P2 it continues to sample P1. If P1 becomes active P2 is not sampled. A non-active channel sequence will be: NP1, P1, P2, NP2, P1, P2, NP3. . . .

DYNAMIC PRIORITY

The Dynamic Priority feature allows the priority of a mode in the scan list to be temporarily modified when the mode is active by pressing the **[Sel]** button. A non-priority mode can be temporarily changed to a second priority.

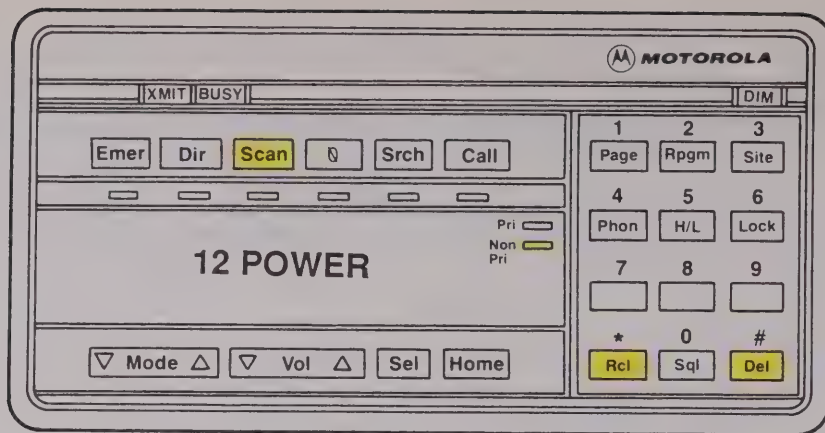
The scan list is restored to the normal priority assignment when the **[Rcl]** button is pressed, the scan is turned off and on, by changing modes, or by turning the radio off and on.

This feature can be enabled or disabled through field programming and is shipped from the factory disabled.

PRIORITY ALERT TONE

Whenever first or second priority level activity is detected, the operator will be alerted by a short tone as the display changes to indicate the priority mode name.

This is a field programmable feature that allows the customer to have the alert tone activated on both levels of priority, either level of priority or totally disabled. This is not mode driven, so it will be active on all modes or none at all.



TALK BACK SCAN

This enhancement to Channel Scan monitoring allows the mobile unit to transmit on the last active receive mode regardless of what mode is selected on the Control Unit. A field programmable variable delay occurs after the transmission to allow the operator to "talk back" to that channel without changing the mode selector.

Careful consideration should be given here with respect to delay time, size of scan list in relation to the amount of channel activity and operator specifics. The delay times are referred to as Scan Hang Times. See SCAN HANG TIMES for a definition of this.

This feature can be enabled or disabled through field programming.

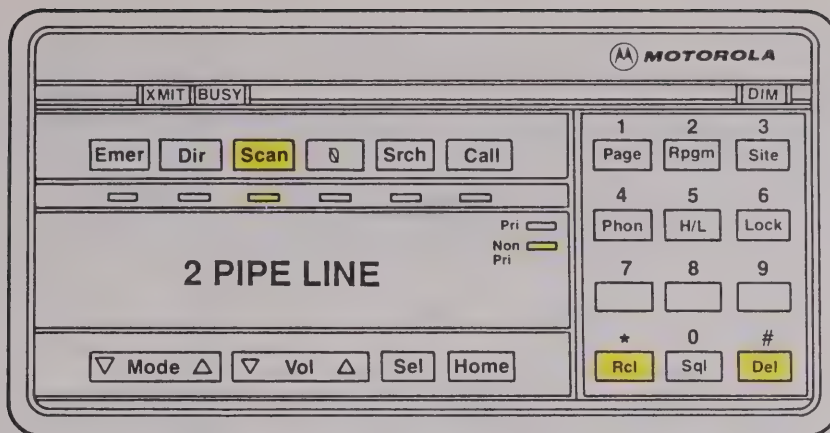
SCAN HANG TIMES

In scan equipped radios, a variable receive hang time is available which determines the time delay from the end of the receive transmission and the start of the scan sequence again. This field programmable value can be useful in ensuring uninterrupted reception of conversations. In addition, a separate variable time delay is used with a transmit hang time. The transmit hang time is the time delay after release of PTT, before the scan sequence begins again. Scan Hang Times are used in the programming of Talk Back Scan.

SCAN ENABLE

This is a field programmable feature that allows the customer to decide in which modes to have Operator Select Scan enabled or disabled. What this does essentially is allow the radio to have a combination of Mode Select Channel Scan monitoring and Operator Select Channel Scan monitoring.

The customer can decide which modes are restricted from mobile operator modification.



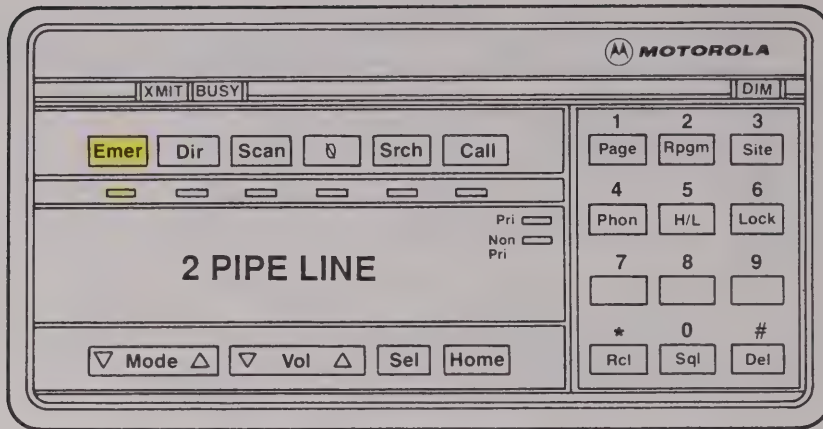
SCAN SQUELCH

Through field programming by mode, when **[Scan]** is pressed, all the PL/DPL channels in that scan list will become carrier squelched. The radio is shipped from the factory to sample for coded squelch.

NUISANCE MODE DELETE

A non-priority mode in the scan list that becomes too active, or for other reasons is no longer desirable to scan, may be temporarily deleted by pressing the **[Del]** button while the mode is active. The mode that was temporarily deleted can be restored again by one of four events, pressing the **[Rcl]** button, if scan is turned off and on again, the radio is turned off and on again, or the operator changes selected modes.

Multiple nuisance channel deletes are permitted. This feature can be enabled or disabled through field programming and is shipped from the factory enabled.



MODE SLAVED SCAN

This field programmable capability replaces the Operator Select Scan with a mode slaved preprogrammed scan list that cannot be permanently altered by the operator in any manner other than to perform a temporary delete of a "Nuisance" channel.

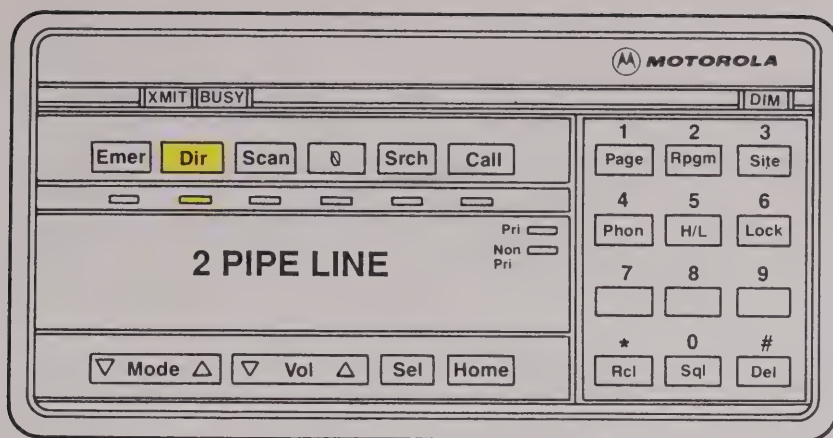
Fleet discipline is enhanced by predetermining the modes each operator will be able to scan.

Up to 16 conventional or 8 trunked talk groups may be selected per scan list. Consideration should be given to the size of the conventional scan list because the larger the list, the slower the effective rate of scan becomes for non-priority talk group sampling.

* OPERATING INSTRUCTIONS [Scan]

Scan can be turned on and off by pressing the [Scan] button. When scan is on, the red indicator below the button will be lit and the internal scan list for the selected mode is enabled.

When scan activity exists, the currently active mode number and name is displayed and the appropriate priority or non-priority indicator will light. If no activity exists, the display indicates the selected mode until activity on a scanned mode occurs.



REPEATER TALK AROUND (Conventional)

This feature provides repeater talk-around capability. It directs the mobile to an alternate transmit frequency, and to a squelch code that is identical to the receive squelch code. This is useful for direct mobile-to-mobile and mobile-to-portable communications.

To activate, press the **[Dir]** button. An indicator below the button will light. Press the microphone PTT and talk. Pressing the button again deactivates talk around and returns the radio to the repeater frequency.

MULTIPLE CODED SQUELCH CAPABILITY (Conventional)

When in conventional operation, the operator has the flexibility to combine carrier squelch, Private-Line and Digital Private-Line codes all in the same radio. Transmit codes can be different from receive codes without restriction.

Multiple coded squelch capability allows the SYNTOR X 9000E radio to operate in many different conventional systems, even when a variety of squelch codes are used.

Operator select multiple coded squelch can be added by field programming the radio and ordering the **[MPL]** button through National Parts. This enables the operator to override the mode slaved coded squelch with a choice of 16 squelch combinations. For a more detailed definition see Section 1.0 **OPERATOR SELECT MULTIPLE CODED SQUELCH (W290)**.

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TRUNKING OPTIONS

SYSTEM EXPANSION OPTIONS

The following options provide expanded system, personality and conventional mode capabilities.

- * 8 Systems / 16 Subfleets / 64 Modes (W829)
- * 16 Systems / 8 Subfleets / 64 Modes (W305)
- * 15 Systems / 16 Subfleets / 8 Modes (W306)
- * 25 Systems / 8 Subfleets / 32 Modes (W709)

AUTOMATIC MULTIPLE SITE SWITCHING - AMSS (W821)

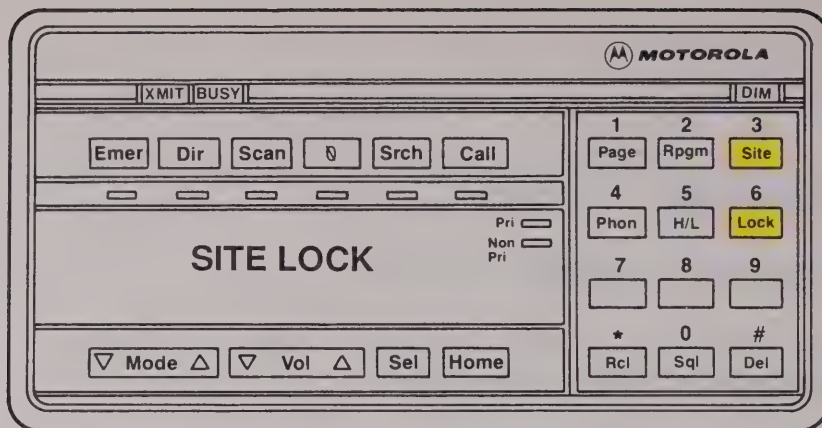
The AMSS option allows the mobile operator to communicate beyond the reach of a single site. In a single system where wide area coverage is required, up to eight trunking sites can be utilized.

The AMSS option automatically switches the radio to a different site when the signal of the current site becomes too weak. This typically happens as the radio moves out of range of one site and into range of another.

If the operator is aware that weak signals are common in a particular area, the AMSS Lock function may be used to prevent the radio from automatically scanning for a new site.

- * Operator Initiated AMSS Operation
- * Locking onto a Site

continued next page



Operator Initiated AMSS [Site]

* OPERATING INSTRUCTIONS

Pressing the **[Site]** button will display the site the radio has currently selected.

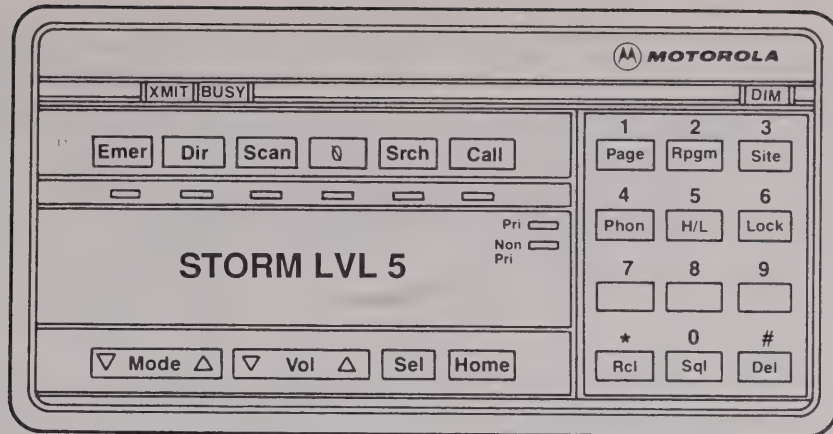
The operator can manually initiate a scan to another site during weak signal conditions by pressing and holding the **[Site]** button until an alert tone (beep) is heard. The display will then show "SITE SCAN" until a new site is selected.

Locking Onto a Site [Lock]

* OPERATING INSTRUCTIONS

Pressing the **[Lock]** button will display the current status as either "SITE LOCK" (if the radio is inhibited from automatically scanning) or "SITE UNLOCK" (if the automatic scanning function is enabled).

To change the locked or unlocked condition, press and hold the **[Lock]** button until an alert tone sounds and the display changes to the alternate condition.



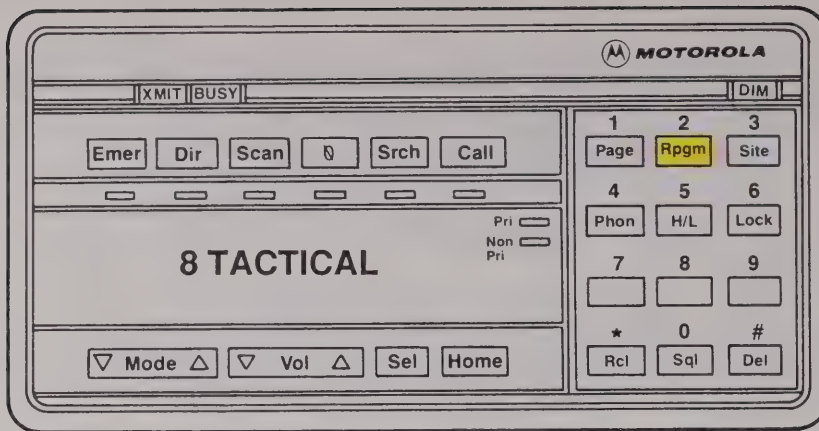
DYNAMIC REGROUPING (W822)

Fleet and subfleet assignment may be reconfigured while the unit is operating in its standard environment. The Dynamic Regrouping option allows the dispatcher to temporarily reassign selected individuals operating in separate fleets and/or subfleets into a single group.

Emergency situations or special events may require a set of talk groups not available in the normal operation. For example, during a threatening storm, units from police, fire and public works may have a need to talk to each other even though they normally would not.

This is accomplished by the dispatcher taking selected unit IDs and reassigning them together on a common subfleet. The selected units need not be members of the same fleet to begin with. These units can also share the same failsoft channel.

Another feature of Dynamic Regrouping is the ability of the dispatcher to selectively enable or disable the unit from changing from this dynamically regrouped fleet.



Receiving a Dynamic Regrouping ID Assignment

* OPERATING INSTRUCTIONS

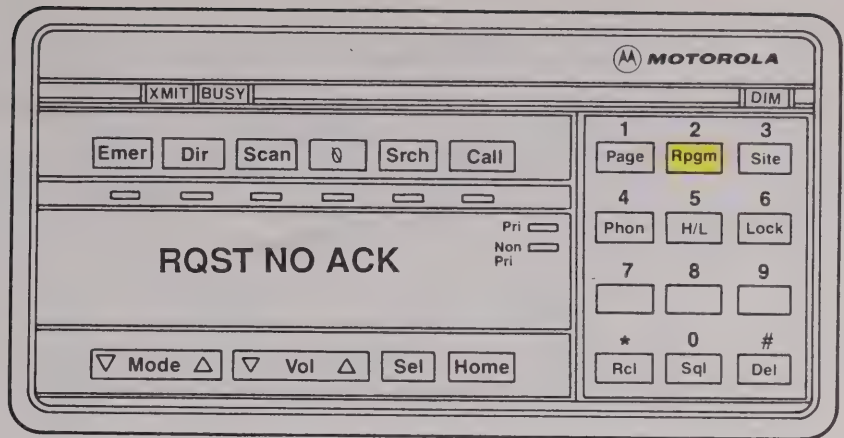
When receiving a Dynamic Regrouping ID assignment, the operator hears a unique alert tone chirp indicating that the radio has been dynamically reconfigured. The display then indicates the new dynamic mode assignment (names are field programmable and might be "16 DYNAMIC" OR "8 TACTICAL", etc.).

When the operator presses the microphone PTT button, the radio then transmits on the dynamically assigned mode.

Momentarily pressing the **[Rpgm]** button allows the operator to see if the radio currently has a dynamic ID assigned mode. If a Dynamic Regrouping command has not occurred, the display shows "DYN REG OFF". This indicates that the dynamic mode is currently invalid. If a Dynamic Regrouping command has occurred, the display will show "DYN REG ON".

If no dynamic regrouping assignment has been made, the operator hears a low pitched continuous tone when selecting a dynamic mode. This indicates the selection is not valid.

continued next page



Requesting Dynamic Regrouping

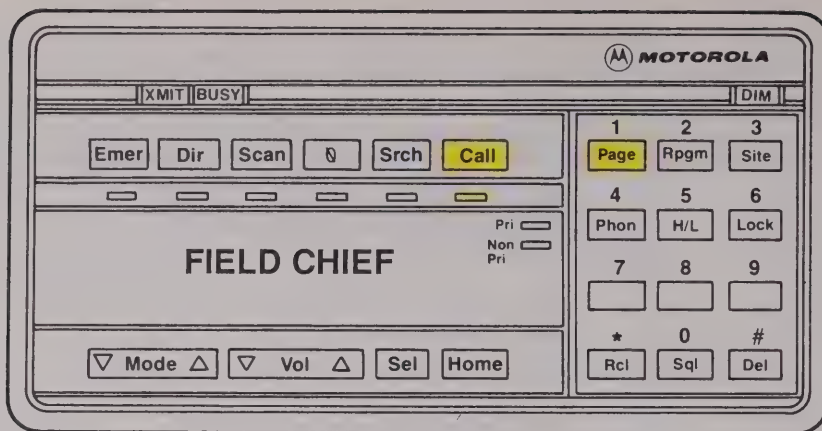
* OPERATING INSTRUCTIONS

The operator may request regrouping by pressing and holding the **[Rpgm]** button.

A central acknowledgment tone (beep) sounds, indicating that the request was received by the system central controller. The display will change to "PLEASE WAIT" while the request is being processed.

If the regrouping request is not acknowledged within 6-8 seconds after the request is initiated, the display shows "RQST NO ACK" and returns to the normal operating mode.

If the regrouping request is acknowledged, a dispatcher acknowledgment tone sounds (4 beeps) and the display returns to normal operation. This indicates that the dispatcher terminal has logged the regrouping request.



SELECTABLE "PRIVATE CONVERSATION" CALL / "CALL ALERT" PAGE (W820)

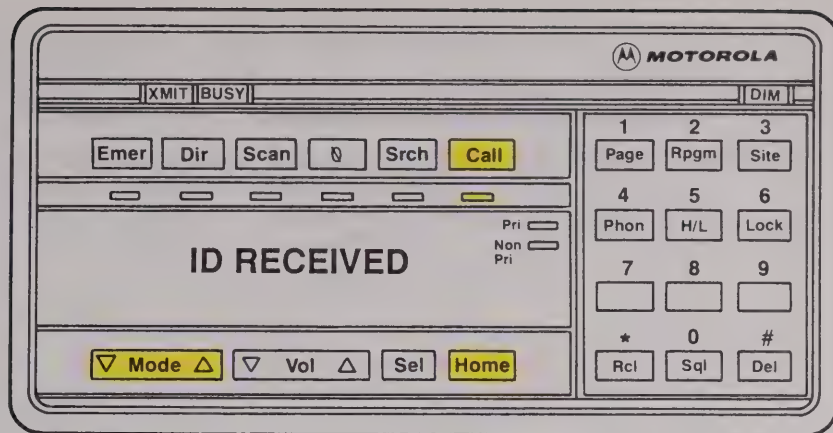
This option provides the user with unlimited Private Conversation call and Call Alert encode / decode capability. It allows the operator to page (Call Alert) or hold a Private Conversation call with any properly equipped radio in the trunking system.

The operator has the flexibility to select a target unit from the prestored list of up to nine frequently called units or use the keypad to encode any properly equipped unit in the system.

This option provides total system access. The simplicity of quickly selecting target radios, coupled with the ability to display meaningful names, makes this option extremely easy to use.

- * Initiating a Private Conversation call
- * To receive a Private Conversation call
- * Initiating a Call Alert page
- * To receive a Call Alert page
- * Storing Call and Page ID Numbers in Memory

continued next page



Initiating a "Private Conversation" Call

* OPERATING INSTRUCTIONS

To initiate a Private Conversation call, the operator presses the **[Call]** button. An alert tone (beep) sounds and the red indicator light blinks. The display alternates between "SCRATCH PAD" and the last ID called. Now the operator can use the keypad to enter the desired 6-digit ID number or use the **[Mode]** rocker to scroll through the prestored list of names and their associated ID numbers.

Once the desired ID number / name is selected, the call may be initiated by pressing the microphone PTT button. Pause for a second to allow the alert tone to be heard by the receiving unit and then begin the conversation.

After completing the Private Conversation call, press the **[Home]** button to return the radio to normal operation.

To Receive a "Private Conversation" Call

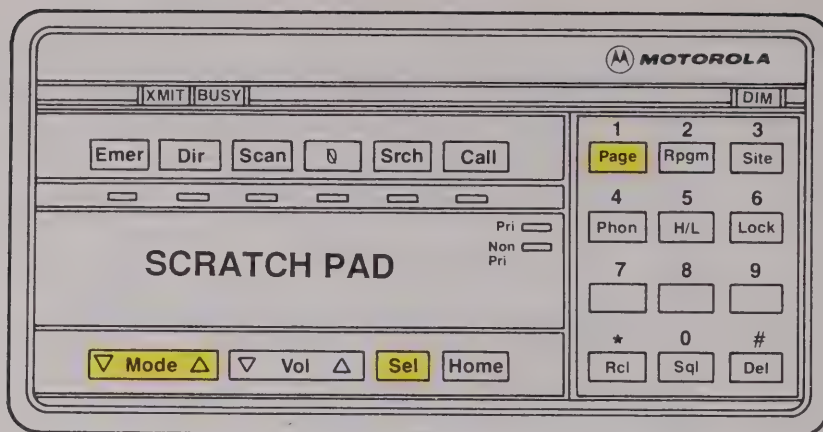
* OPERATING INSTRUCTIONS

When a Private Conversation call is received, two alert tones (beep-beep) sound and the display shows "CALL".

The call is answered by pressing the **[Call]** button. An alert tone (beep) sounds and the red indicator light begins to blink. The display changes to "ID RCVD". The operator may now respond to the call by pressing the microphone PTT.

After completing the Private Conversation call, press the **[Home]** button to return to normal operation.

Note: If the radio is equipped with Horn and Light Alarms, see the W116 External Alarms section.



Initiating a "Call Alert" Page

*OPERATING INSTRUCTIONS

To initiate a Call Alert page, the operator presses the **[Page]** button. An alert tone (beep) sounds and the display alternates between "SCRATCH PAD" and the last ID paged. Now the operator can use the keypad to enter the desired 6-digit ID number or use the **[Mode]** rocker to scroll through the prestored list of names and their associated ID numbers.

Once the desired unit has been selected, the page may be initiated by pressing the **[Sel]** button. The display shows "PLEASE WAIT" while the page is being processed.

When the mobile unit being paged receives the signal, it sends an acknowledgment back to the initiating unit. The operator then hears four alert tones (beeps) and the display shows "ID PAGED". The radio then immediately reverts back to the normal operating mode.

If the acknowledgment is not received within three to five seconds after the page has been transmitted, the display will show "PAGE NO ACK". Press the **[Home]** button to return the radio to normal operation.

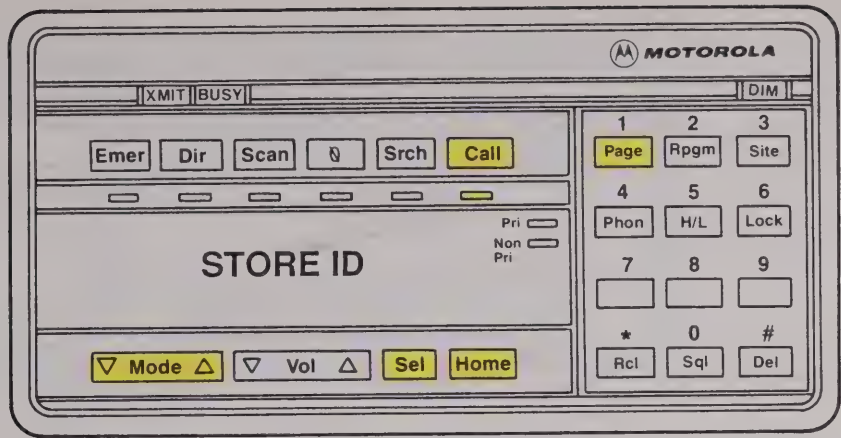
To Receive a "Call Alert" Page

*OPERATING INSTRUCTIONS

When a Call Alert page is received, the operator hears four alert tones (beeps) and the display flashes "PAGE". This sequence is repeated periodically until the operator answers the Page by pressing the microphone PTT button.

Note: If the radio is equipped with Horn and Light Alarms, see the W116 External Alarms section.

continued next page



Storing Call or Page ID Numbers in Memory

*OPERATING INSTRUCTIONS

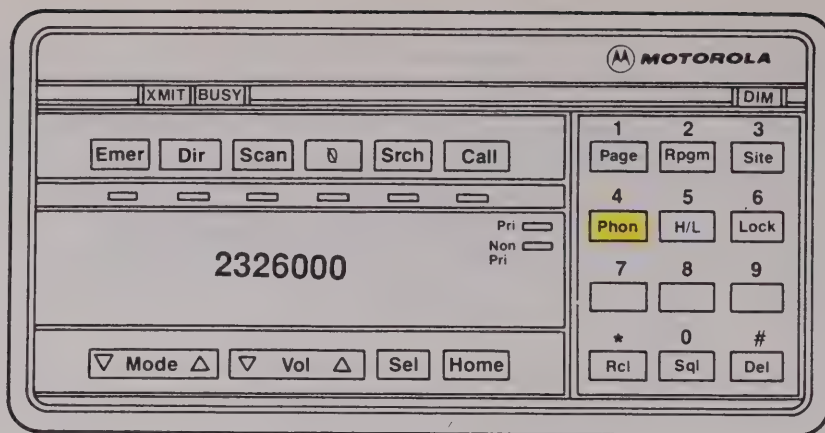
To store call or page IDs in memory, first press the **[Call]** or **[PAGE]** button. An alert tone (beep) sounds and the red indicator light blinks. The display then shows the last ID called.

Use the **[Mode]** rocker to scroll to "STORE ID" and then press the **[Sel]** button. The display changes to "UNIT 1", "UNIT 2", etc.. (call and page names can be field programmed)

If the call or page name is left on the display for more than two seconds, the display changes to the ID currently stored in that location. Left alone, the display alternates between the name and ID number every two seconds. This allows the operator to review the ID number before changing it.

When the desired memory location is displayed, use the keypad to enter the ID number to be stored.

After the ID has been entered, press the **[Sel]** button to store it in memory and continue making other changes or press the **[Home]** button to return to normal operation.



TELEPHONE INTERCONNECT (W20)

This option activates the keypad on the Control Unit to make and receive telephone calls through the trunking centralized telephone interconnect.

Operator convenience is further enhanced with the ability to store frequently called numbers (up to nine) along with a meaningful name for each phone number. The operator simply looks for the desired name and can then autodial the associated telephone number.

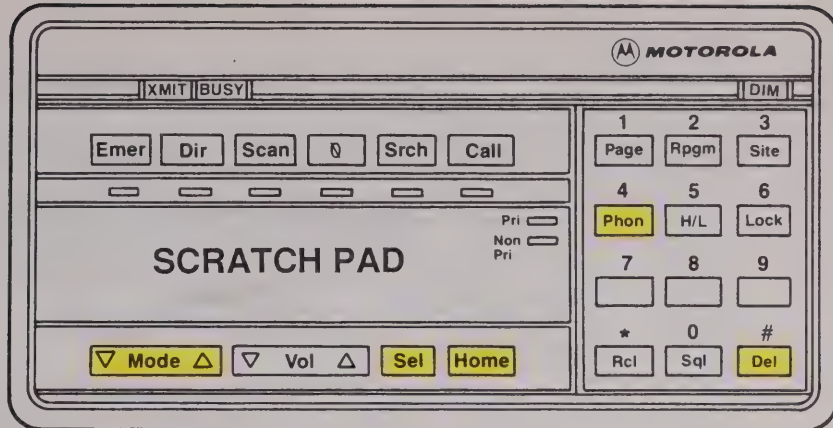
Another key feature is the ability to convert the Control Unit display into a "scratch pad" during a phone call. For example, the operator could call information to get a particular phone number and write it down on the display using the keypad. The number would then be stored and could be autodialed at a later time.

For those operators that occasionally need to use the telephone, finding a phone booth on the road is difficult and time consuming. With SYNTOR X 9000E radio, telephone calls are only a pushbutton away.

- * Scratch Pad Dialing
- * Keypad Dialing
- * Auto Dialing from memory
- * Storing Phone Numbers
- * Receiving a Telephone Call

NOTE: This option can activate External Alarms (W116).

continued next page



Scratch Pad Dialing

* OPERATING INSTRUCTIONS

Using the Scratch Pad to dial a telephone number allows the operator to enter the digits and make corrections before the number is actually sent. After a number is dialed, it is also stored in the scratch pad memory. It remains in memory until another number is entered from the keypad.

To initiate a call, press the **[Phon]** button. An alert tone sounds and the display alternates between "SCRATCH PAD" and the last number dialed.

The operator may now enter the phone number. If a wrong number is entered, pressing the **[#]** button two times erases the last digit. When the desired number is on the display, press the **[Sel]** button to dial.

When the landline party answers, explain that only one person can talk at a time. Each time the microphone PTT button is released, the listener hears a soft tone (beep). This is their cue to begin talking. Proceed with the conversation in a normal push-to-talk manner.

When the phone conversation is over, press the **[Home]** button to return to normal operation.

Keypad Dialing

* OPERATING INSTRUCTIONS

Keypad dialing allows the operator to send the DTMF tones as the keypad digits are pressed.

To initiate a call, press the **[Phon]** button. An alert tone sounds and the display alternates between "SCRATCH PAD" and the last number dialed. Now use the **[Mode]** rocker to scroll to "KEYPAD DIAL" and press the **[Sel]** button.

When a dial tone is heard, the operator can begin to dial the number using the keypad. Proceed as explained in Scratch Pad Dialing.



Auto Dialing From Memory

* OPERATING INSTRUCTIONS

To initiate a call, press the **[Phon]** button. An alert tone sounds and the display alternates between "SCRATCH PAD" and the last number dialed. Now use the **[Mode]** rocker to scroll to the desired name/number. Press the **[Sel]** button to automatically dial.

If any characters in the number are a "P" (pause), the radio de-keys until the **[Sel]** button is pressed again. This causes the mobile to send the remainder of the number. Proceed as explained in Scratch Pad Dialing.

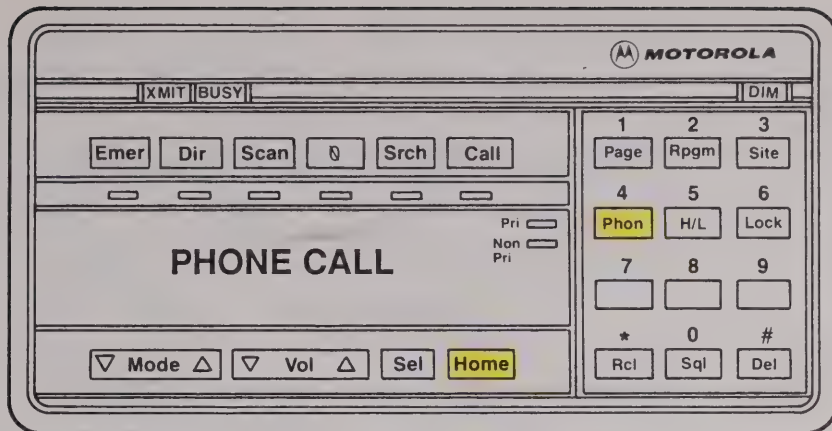
Storing Phone Numbers

* OPERATING INSTRUCTIONS

To store phone numbers in memory, press the **[Phon]** button. An alert tone (beep) sounds and the display alternates between "SCRATCH PAD" and the last number dialed.

Now use the **[Mode]** rocker to scroll to "STORE PHONE" and press the **[Sel]** button. The **[Mode]** rocker is now used to scroll through the choices. The display then indicates "PHONE 1", "PHONE 2", etc. (phone names can be field programmed). When the desired memory location is displayed, use the keypad to enter the number to be stored.

After the number has been entered, press the **[Sel]** button to store it and continue to make other changes, or press the **[Home]** button to store it and return to normal operations.



Receiving a Telephone Call

* OPERATING INSTRUCTIONS

When a landline party wants to initiate a call, the caller dials the interconnect terminal phone number. If the system is busy, the caller hears a normal busy signal and has to redial the number. If the phone line is available, the caller hears a tone. The caller then enters the access code (ID number) of the individual to whom he wishes to talk. Both the landline party and the mobile operator will hear a ringing tone.

To answer a call, the mobile operator presses the **[Phon]** button. Then an alert tone (beep) sounds and the display shows "PHONE CALL". The operator presses the microphone button to begin the conversation.

When the phone conversation is over, press the **[Home]** button to return to normal operation.

Note: If the radio is equipped with Horn and Light Alarms, see the W116 External Alarms section.

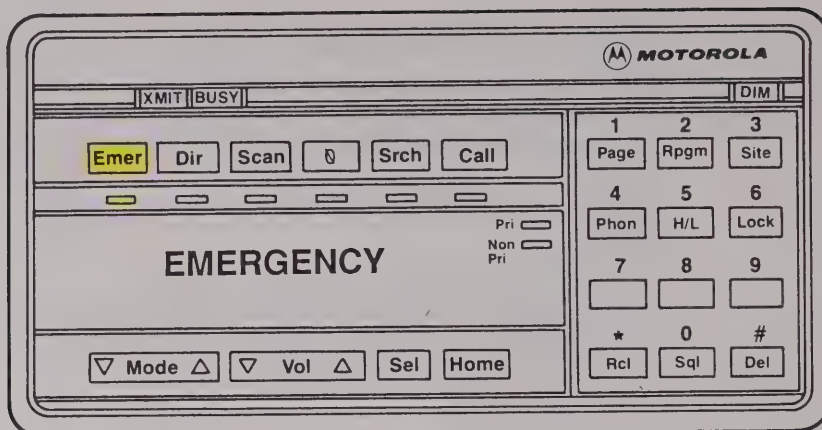
Omit Emergency Alarm/Call (W826)

This option deletes the **[Emer]** button and the capability for Emergency Alarm/Call. An application that only called for PRIVACY PLUS trunked systems would be a reason for the (W826) option. A radio can be ordered with emergency turned off on all personalities through TCMS without (W826).

Omit Trunking Operation (W238)

This option is required if trunking operation is not desired. The trunking board is removed from the radio but can be field retrofitted when needed.

CONVENTIONAL OPTIONS



"MDC-1200" UNIT ID AND EMERGENCY ALERT (W814)

Every time the push-to-talk switch is activated on a mobile, its unit ID number is automatically displayed at the console. The dispatcher immediately knows who's on the air, eliminating the need for voice ID transmissions. Since all transmissions are "signed", the dispatcher can identify any operator who is using the system for non-business purposes.

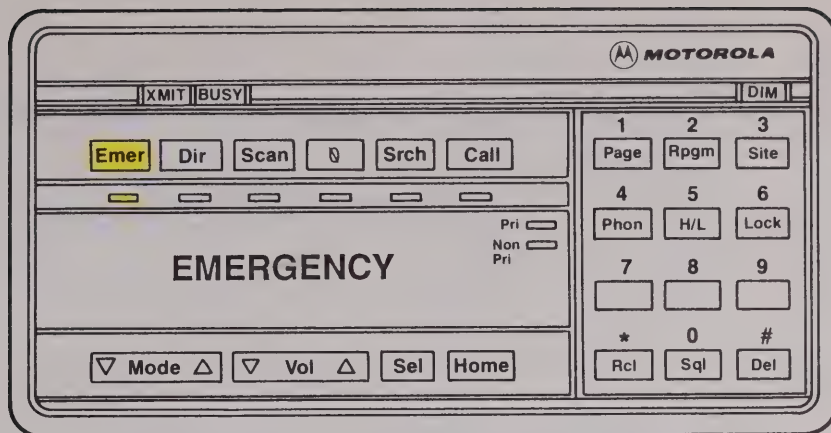
The Emergency Alert feature of this option allows an operator to send an emergency message that flashes that unit's ID number and sounds an alarm to the dispatcher.

Emergency operation in the mobile can be programmed to be either silent or audible. If the radio is equipped with Silent Emergency, the receive audio will be muted and there will be no indication in the vehicle (no lights or audio including dispatch) that an Emergency signal has been sent. The radio will remain in this condition until the operator pushes PTT. This feature enhances operator safety during a life threatening event.

Emergency Alert transmissions have absolute priority over any other radio function in progress. Keying the microphone only temporarily suspends it. The mobile can send the Alert up to 20 times, and after base acknowledgment it ceases.

All MDC-1200 Signalling transmissions can be printed at the fixed end to provide hard copy documentation of all radio traffic. Every transmission print out includes the time and date of each transmission and the ID of the message originator. When a trailing ID is also programmed into this option, the duration of each transmission can also be determined.

Continue next page for operation



* OPERATING INSTRUCTIONS

Every time the operator pushes the microphone PTT the unit identification number for that vehicle is automatically sent.

The Emergency Alert feature can be activated by pressing the **[Emer]** button on the Control Unit. Optional devices to activate the Emergency Alert include the Hidden Pushbutton (W688) and Hidden Footswitch (W470) which require programming of one of the Vehicle Interface Ports (VIP) on the "Systems 9000" Control Unit.

"MDC-1200" SELECTIVE CALL ENCODE/DECODE (W412)

This option includes all the features of Unit ID and Emergency, plus the ability for the dispatcher to selectively call an individual unit, a group of units, or the entire fleet. In addition, a mobile can selectively call another properly equipped mobile. The voice transmissions include a data packet that causes the receiving units to unmute. During a unit-to-unit selective call, the name of the caller, if programmed in the Control Unit, or the caller's unit ID number appears on the receiving unit's display for as long as the caller keys the microphone switch.

The ability for one mobile to selectively call another mobile is further enhanced with the ability to store up to nine frequently called units in the control unit's memory. The operator can use the keypad to enter a specific unit's ID number or scroll through the prestored Names and their associated numbers to select the desired unit.

Note: MDC-1200 Selective Call Encode/Decode is not compatible with SECURENET enabled modes.

* OPERATING INSTRUCTIONS

See the instructions for trunking Selectable "Private Conversation" call and "Call Alert" option (W820).

DTMF / TELEPHONE INTERCONNECT (W946)

This option provides both conventional telephone interconnect and DTMF encode/decode capability. It allows the use of the Control Unit keypad for selective signalling (including unit-to-unit), remote signalling applications and mobile telephone operations.

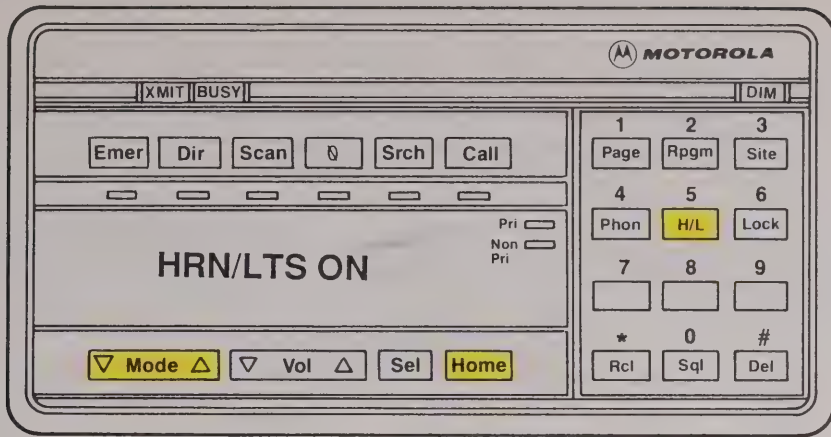
Similar to the trunking options, the operator can store up to nine frequently called telephone numbers and nine unit numbers along with a meaningful name for each. The operator simply looks for the desired name and then can autodial the associated number. For additional information on features and operating instructions that are unique to DTMF see Section 1.0 DTMF/Telephone Interconnect (W946).

This option can also activate External Alarms (W116).

OMIT CONVENTIONAL OPERATION (W827)

If the radio is to be used for trunking applications only, this option deletes the requirements for conventional information such as frequencies and squelch codes.

TRUNKED AND CONVENTIONAL OPTIONS



EXTERNAL ALARM (W116)

With this option, incoming telephone calls, Private Conversation calls/Call Alert pages, and selective calls will alert the operator by sounding the horn, turning on the lights, or both. Duration of these alarms is field programmable.

The operator can select the type of alert desired before leaving the vehicle. The choices appear in plain English on the Control Unit's display making the selection quick and easy. It's the perfect solution for people that are frequently away from their vehicles.

* OPERATING INSTRUCTIONS

Pressing the [H/L] button will turn the External Alarm option on and activate the last selected alarm type. Pressing the [H/L] button again will turn the option off. When the feature is turned on, the display will alternate between the currently selected mode and type of Alarms (i.e., "Horn On") activated.

To change the External Alarm setting, the [H/L] button is held down until a beep is heard and the current alarm selection shows on the display. The operator can then use the [Mode] rocker to scroll through the choices of "HORN ON", "LIGHTS ON" or "HRN/LTS ON". Once the desired Alarm is displayed, pressing the [Home] button will return to normal operations with the Alarm option turned on.

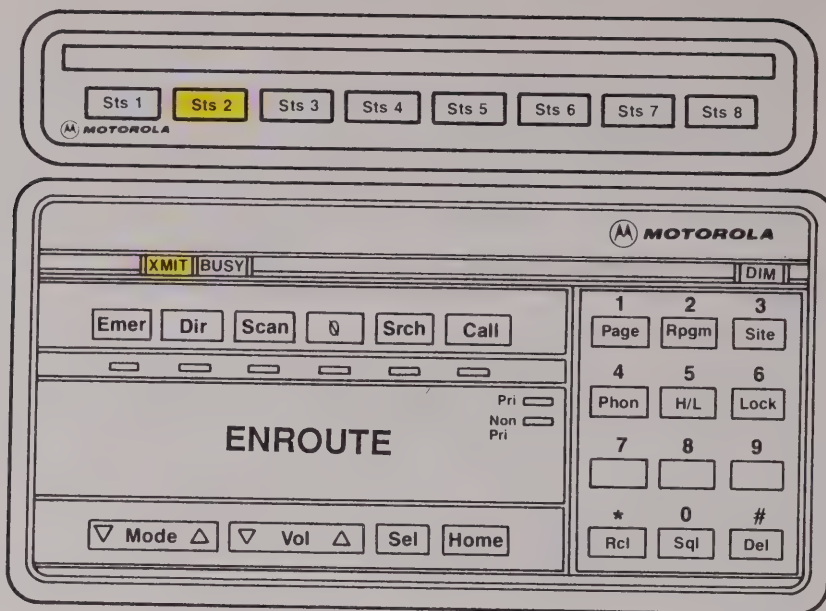
EMERGENCY HIDDEN PUSHBUTTON (W688)

Provides button external to radio. Requires Vehicle Interface Port (VIP) field programming.

EMERGENCY HIDDEN FOOTSWITCH (W470)

Provides footswitch external to radio. Requires Vehicle Interface Port (VIP) field programming.

DIRECT ENTRY STATUS/MESSAGE



MDC-1200 8 Status/Message	(W370)
Trunked 8 Status/Message	(W354)
BOTH Trunked and MDC-1200 8 Status/Message	(W355)
MDC-1200 8 Status / 8 Message	(W941)
Trunked 8 Status / 8 Message	(W373)
BOTH Trunked and MDC-1200 8 Status / 8 Message	(W374)

These options provide status/message capability for trunking, conventional MDC-1200 Signalling or both systems.

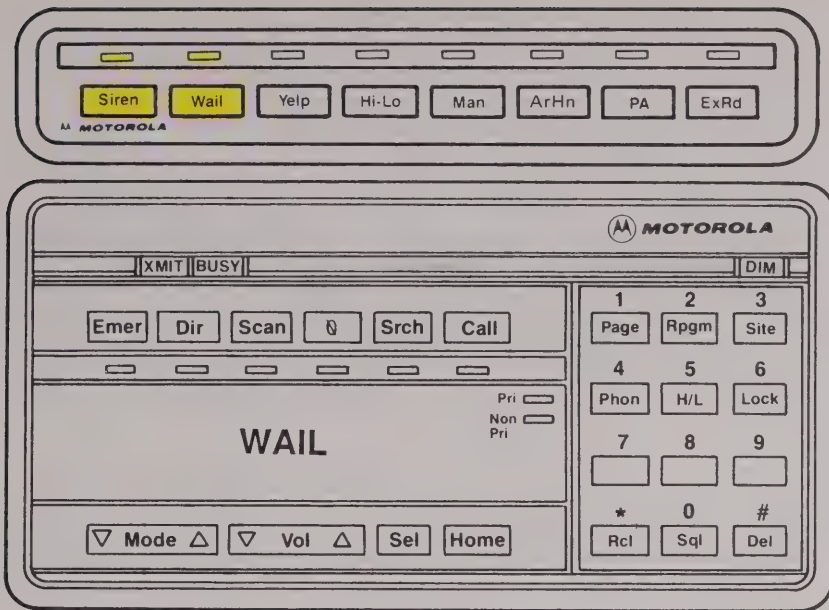
Dedicated buttons with indicators are positioned in an attractive housing that mounts directly above the Control Unit and uses the same mounting bracket. The 8 status / 8 message options include two housings (8 buttons in each).

The MDC-1200 Status/Message option also includes MDC-1200 ID and Emergency Alert capability (see W814). A status message such as "ENROUTE" or "OUT OF SERVICE" can be quickly sent to the dispatcher without using valuable air time. Since the same buttons are used for conventional and trunked status/message, the operator never needs to be concerned about whether he is operating in a trunked or conventional system.

NOTE: These options include extra status and message buttons allowing configuration of the unit to meet individual requirements. For example, 6 status and 2 message buttons may be all that are installed.

*OPERATING INSTRUCTIONS

The operator simply pushes the desired status/message button.



ELECTRONIC SIREN AND PUBLIC ADDRESS (W269)

The "Systems 9000" radio's Siren/PA provides traffic and crowd penetrating capabilities with 100 watts of continuous duty siren output power, and 50 watts of public address output power. It also survives the grueling demands of MIL STD 810D.

For operator convenience, the control buttons are positioned in a supplemental housing that mounts directly above the Control Unit using the same mounting bracket.

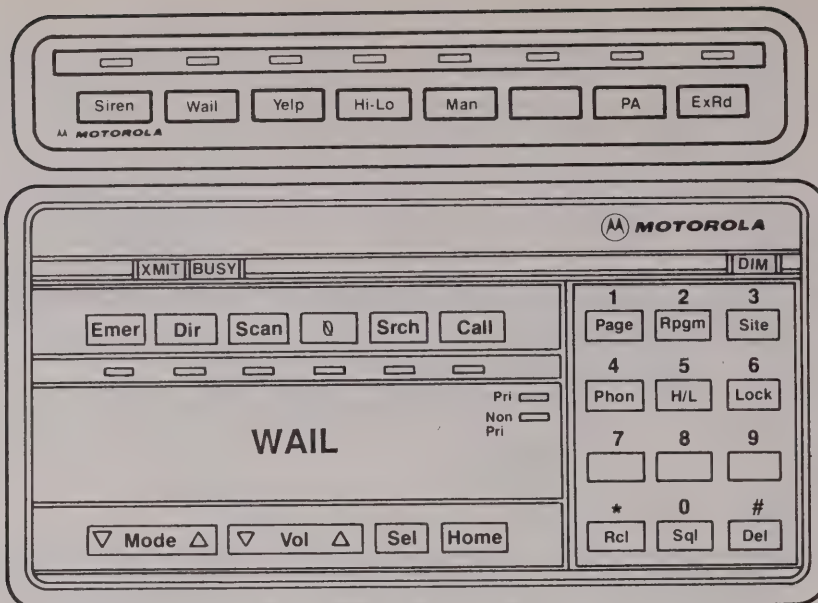
The separate amplifier can be mounted within 5 feet of the radio. If the vehicle were to stall while the siren is on, the siren would automatically activate once the vehicle was restarted.

Selections of various functions are made possible through field programming of the radio's EEPROM. Ignition sense for siren, PA, and External Radio and a default PA volume level are all field programmable. The software contains Speaker Short Detection algorithms that protect the Siren/PA in case of unexpected hardware failure. This failure will be indicated on the Control Unit display.

Note: The speaker must be rated at 11 ohms.

The various siren/PA functions include the following :

- * Four Siren Sounds
- * Manual Operations
- * External Radio
- * Public Address



* FOUR SIREN SOUNDS

The buttons for **[Wail]**, **[Yelp]**, **[ArHn]**, and **[Hi-Lo]** are conveniently located on a Direct Entry Keyboard.

Press the **[Siren]** button to activate the siren option. The status indicator will light, and the last selected siren function is activated and momentarily displayed. The operator may preselect a function by pressing the desired button on the keyboard when the siren is off. The selected function will momentarily be displayed. The operator may also select a different function while the siren is on. Press the **[Siren]** button again to turn the siren off.

* MANUAL OPERATIONS **[Man]**

Selection of this mode permits control of this siren from an alternate position (for example a footswitch or horn ring) providing the means for hands-free operation during high speed pursuits.

If the "horn-ring" feature is connected, the operator can change from one tone to another by pressing the vehicle's horn ring. This feature, programmed in the Control Head Vehicle Interface Port, is activated through a Horn Ring Transfer Relay when the siren is turned on.

ACTIVE TONE

CHANGES TO

HOW CHANGED

WAIL

YELP

Press and release the horn ring; press ring again to return to WAIL.

YELP

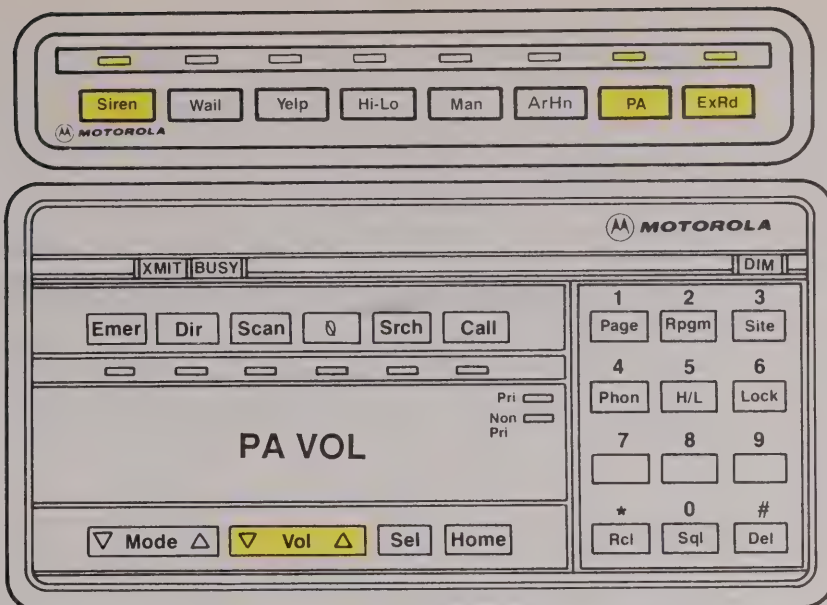
AIRHORN

Press and hold the horn ring.

HILO

YELP

Press and release the horn ring; press ring again to return to HILO.



* EXTERNAL RADIO [ExRd]

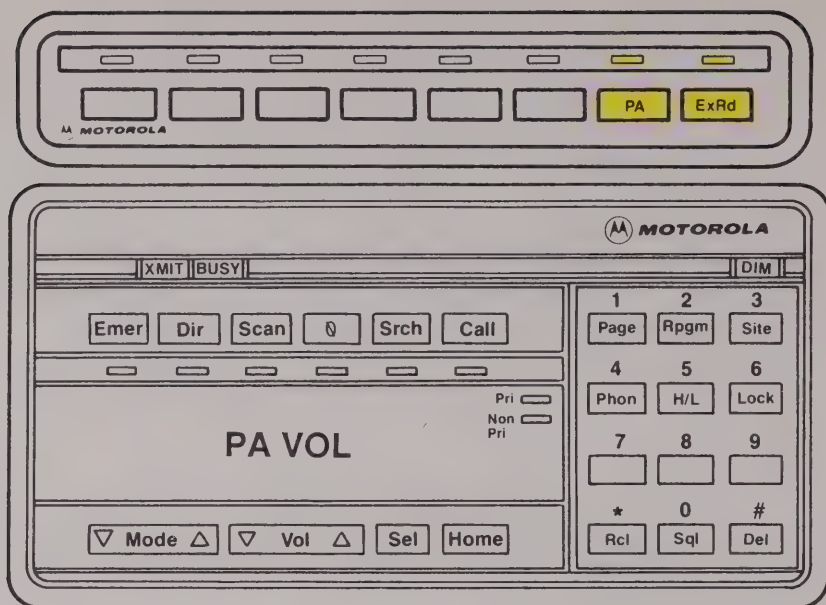
In this mode the radio's receive audio output is amplified by the siren system and reproduced through the siren speaker. This feature is especially desirable when the operator is out of the vehicle but must continue to monitor radio messages. Through field programming, audio such as SECURE coded messages will not be routed externally.

To activate, first press **[ExRd]**, then press the **[Siren]** function. Any incoming radio messages will be re-broadcast over the external speaker. If the siren is sounding and the **[ExRd]** button is pressed, the siren tone is muted abruptly and incoming radio messages are broadcast over the external speaker. The **[Vol]** rocker controls the PA speaker volume. Changing its setting does not affect the radio volume setting or siren intensity. On power-up, the siren function remembers its last setting. The External Radio feature will remain operative until the **[Siren]** button is pressed again, or another siren function Wail, Yelp, etc. is selected.

* PUBLIC ADDRESS [PA]

Public address announcements may be made over the siren speaker using the same microphone provided with the radio. When the PA mode is selected, the microphone will not key the radio transmitter. The PA will also override the siren sound if PTT is pressed. Upon completion of the PA message, the siren sound will automatically continue when PTT is released.

Press **[PA]** to select the public address option. Use **[Vol]** to control PA volume, indicated on the display by "PA VOL". Changing the PA volume setting does not affect the radio volume. The public address overrides all siren functions when PTT is pressed if both siren and PA are selected.



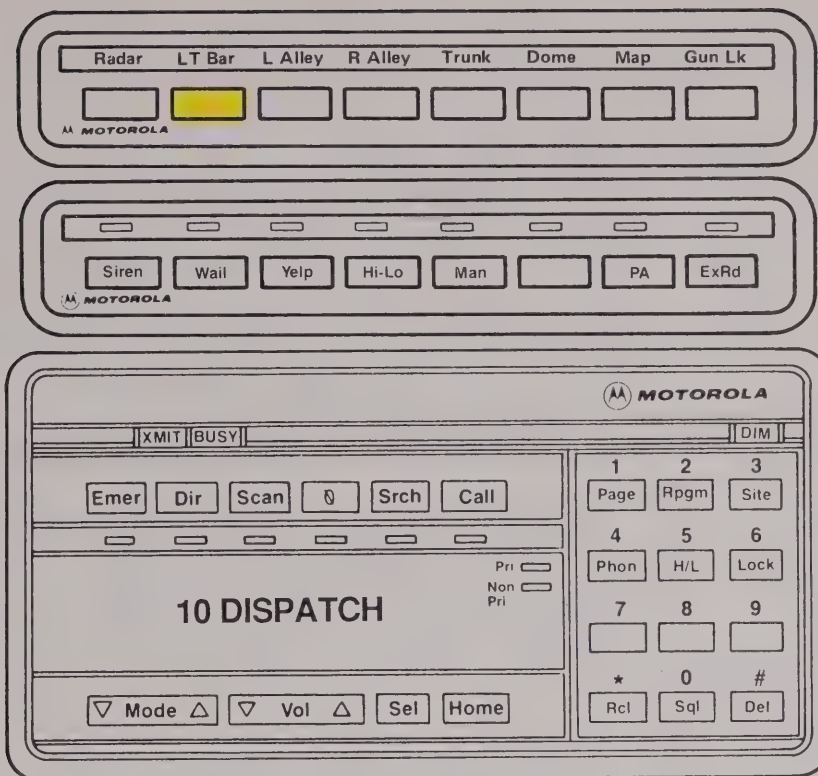
PUBLIC ADDRESS (W589)

This option is for users that require PA and External Radio but not the siren capabilities. It uses the same amplifier as the Siren/PA option and provides 50 watts of Public Address output power. This option also provides the External Radio features and maintains the Mil Std 810D environmental integrity. For operating instructions see (W269)

Note: The [ExRd] button now turns the external radio option off/on without the need of the [Siren] button.

Performance Specifications Electrical Characteristics

PARAMETER	MINIMUM	TYPICAL	MAXIMUM	CONDITIONS
CURRENT DRAIN			8.0 amps	@ 50 watts output with Public Address ON
PUBLIC ADDRESS AUDIO DISTORTION			10%	@ 50 watts output with 80 mV, 1 kHz signal
PUBLIC ADDRESS RATED AUDIO	50 watts			
SIREN RATED OUTPUT		100 watts +or- 10%		@ 13.80 Vdc
SIREN RATED OUTPUT		100 watts +or- 10%		@ 16.60 Vdc
CURRENT DRAIN			13 amps	// siren tones ON
FREQ. RESPONSE		No more than +or- 3dB var.		@ f = 200Hz to f = 10 kHz; ref: 80 mV, 1 kHz signal
REQUIRED SPKR. IMPEDANCE		11ohms		



AUXILIARY SWITCH PANEL (W591)

This provides a supplemental bank of eight (8) switches that can be used to control any of the electrical functions in the vehicle. The first six buttons are push-on/push-off type and the last two are momentary. The buttons are positioned in an attractive supplemental housing that mounts directly above the Control Unit, using the same mounting bracket.

Some suggested uses are winch operation, door locks, gun locks, dome lights, Mars lights, burglar alarm, and many others. A selection of labels is provided with each panel.

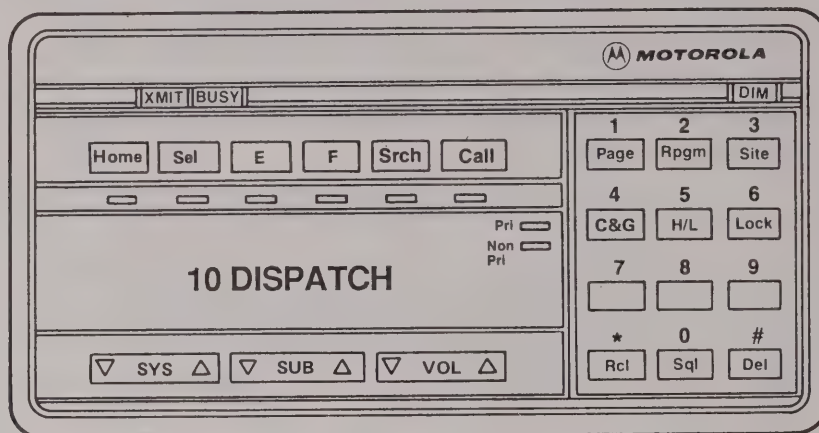
This housing is not environmentally sealed and does not meet MIL STD 810D. Relays can be ordered from National Parts.

CONTROL UNIT OPTIONS

Two optional Control Units are available to provide an alternate method of selecting the desired talkgroup.

* ZONE / MODE CONTROL UNIT (W995)

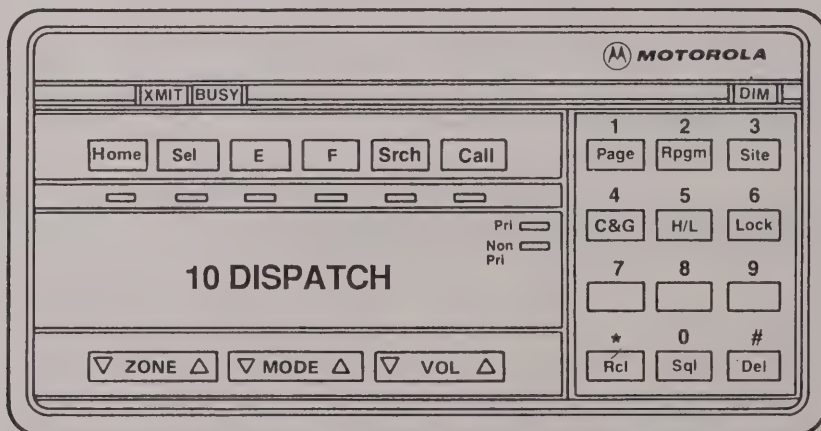
This option provides a rocker type selector for [Zone], [Mode], and [Vol].

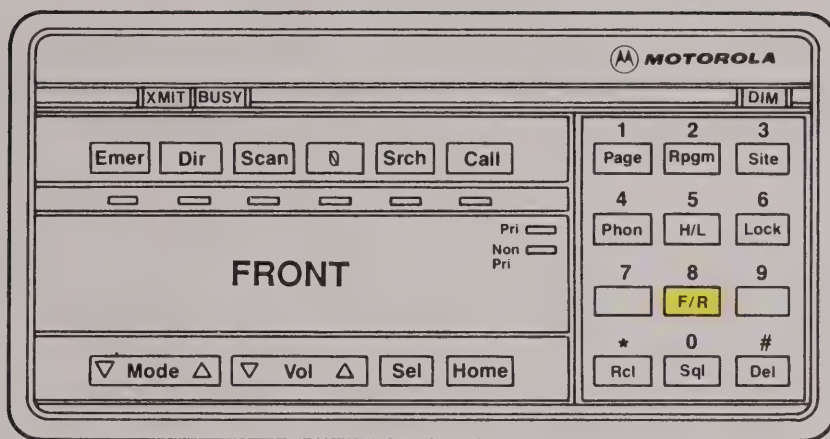


* SYSTEM / SUBFLEET CONTROL UNIT (W996)

This option provides a rocker type selector for [SYS], [SUB], and [VOL]. In order to provide these variations of Control Units, the [Sel] and [Home] buttons are replaced with a third rocker type selector. The replaced buttons are moved to the top of the Control Unit and eliminate the [Emer] and [Dir] buttons.

Activation of the Trunked Emergency feature requires the (W470) Footswitch or (W688) Hidden Pushbutton. The talkaround feature must be mode selectable if either of these Control Units are ordered.





FRONT / REAR CONTROLS (SP - Contact your ASE)

This option provides an additional Control Unit, weatherproof speaker, palm microphone, and a 22-foot cable to allow front and rear operation. The rear operation has the same capability as the front.

*OPERATION

Pressing the **[F/R]** button will toggle from one Control Unit to the other. Mode selection will follow the transfer.

NOTE: Direct Entry Status / Message, Siren / PA, and Auxiliary Switch Panel options are provided on the front Control Unit only.

"SECURENET" OPTIONS

"SECURENET" ENCRYPTION OPTION (W797)

When sensitive information must be transmitted by radio, MOTOROLA's SECURENET Digital Voice Protection system will provide the high level of voice security necessary to make radio communications a more effective tool.

The SECURENET DVP-XL system is capable of providing 2.36×10^{21} unique, unrelated codes. To exemplify the vast number of codes available, a high speed computer processing 100 million instructions per second would require 748,000 years to evaluate this number of codes. Only one code out of 2.36×10^{21} possibilities will produce an intelligible message. There are no families of codes which are capable of providing a partially decoded message. Due to the coding format, the transmission contains no voice components and therefore will sound like white noise to an unauthorized listener.

The SECURENET circuitry digitizes microphone audio, transforms it into cipher, and sends it to the transmitter circuits. Similarly, it transforms received cipher into audio and sends it to the speaker. Logic circuits and audio switches allow the system to operate in either the private (encrypted) mode or the standard (clear) mode.

The private mode uses a digital non-linear coding scheme to digitize microphone audio. This scheme applies the output of a continuously-variable-slope delta modulator (CVSD) to a nonlinear digital encryption circuit. After being filtered, the encrypted data modulates the synthesizer. In the receive mode, cipher from the discriminator goes to a decoder. The CVSD converts the digital output of the decoder to an analog signal and sends it to a filter that shapes it and sends it on to the speaker amplifier circuit.

microphone audio. This scheme applies the output of a continuously-variable-slope delta modulator (CVSD) to a nonlinear digital encryption circuit. After being filtered, the encrypted data modulates the synthesizer. In the receive mode, cipher from the discriminator goes to a decoder. The CVSD converts the digital output of the decoder to an analog signal and sends it to a filter that shapes it and sends it on to the speaker amplifier circuit.

Continued SECURENET

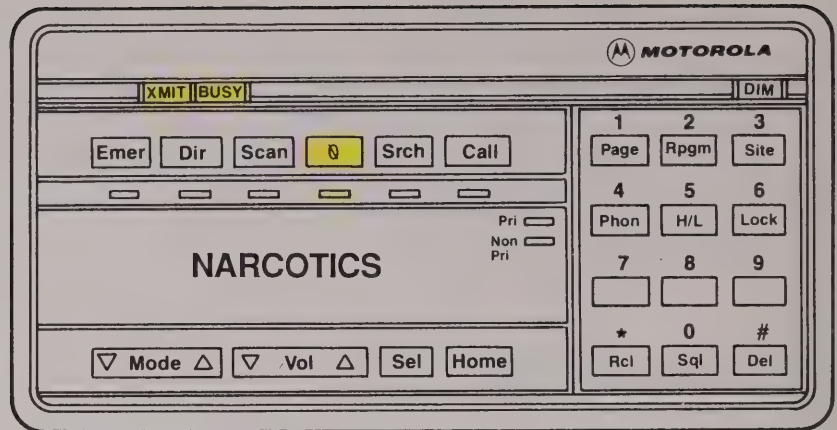
The system stores the code internally, and once the code is loaded it cannot be read. A single electronic key inserter with appropriate interconnect cable allows for a new key to be easily loaded on any schedule. The operator uses the [0] button on the Control Unit to choose either the clear or coded mode for transmitting.

Physically the SECURENET circuitry is on a single board in the radio. The board uses a microprocessor to perform the audio switching and control functions that control the SYNTOR X 9000E radio. On the cable connector at the front of the radio is a six-pin connector through which the electronic encryption key is loaded into the SECURENET board.

Through field programming of Siren functions, SECURE receive transmissions are inhibited from being routed through the External Radio (ExRd) audio.

All of the following functions are available through field programming:

- * On/Off Operation Control - either operator select or mode slaved.
- * Proper Code Detect - enabled or disabled.
- * Receive clear alert tone sounds when a clear signal is received and the SECURENET option is turned on.
- * System Security Monitor - disables the radio if the SECURENET code fails.
- * Echo Muting Time - large systems may require some delay time following Securenet transmissions to cancel echoes. This delay can be set from 0 to 750 milliseconds in 25 millisecond intervals. The default value is preselected at 0.0 seconds.
- * Squelch Sensitivity with Scan On - With this feature, during Securenet operation, scanning sensitivity improves when scanning for weak Securenet signals. When Securenet and scan are on,



* OPERATING INSTRUCTIONS

To transmit a coded message, press the [0]. Doing this lights an indicator directly below the button. If the optional Dual Code feature is enabled, the current Code name temporarily displays when the option is turned on.

When the radio is receiving a coded message, the busy light will flash and the radio unmutes. When transmitting a coded message, the transmit indicator will flash. The SECURENET on/off button does not affect receive messages.

Coded messages encrypted with a different key unmute the radio and produce noise in the speaker. The Proper Code Detect option (W304) eliminates this noise by muting the audio when an incorrect encryption key is detected. This option will ship enabled. It can be totally disabled through field programming or temporarily disabled by taking the microphone off-hook or by using the monitor off/on function.

The SECURENET transmit operation may be mode slaved through field programming. On each mode the option can be slaved on (Transmit coded), off (Transmit clear), or left to operator selection. This allows the customer to ensure that when the mobile operator talks on a selected mode, the transmissions will be coded. In this case, the [0] button does not have to be pressed, yet the indicator light will activate upon selection of the coded slaved mode. If the [0] button is pressed on a mode that is mode slaved, an invalid entry alert tone sounds.

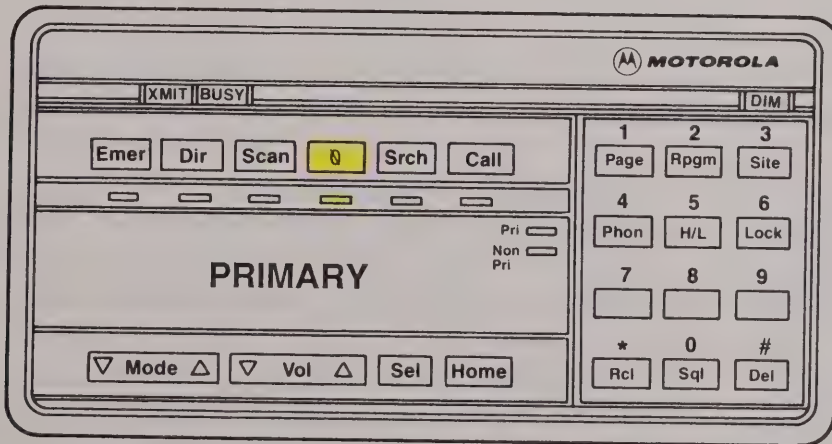
When enabled, a Receive Clear Alert Tone will be heard by the operator if the SECURENET option is turned on and a clear transmission is received. This feature ships from the factory disabled and is not compatible with systems having data preamble before voice transmissions. For example, MDC PTT ID or Single Tone signalling.

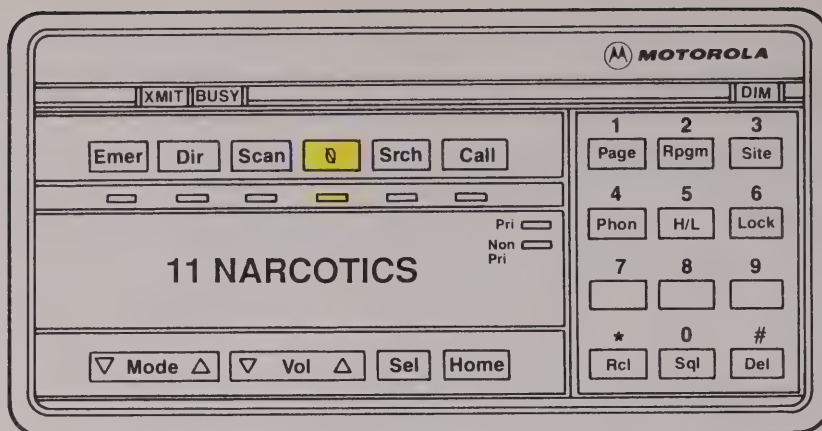
A standard feature found on DVP-XL and DES-XL equipped radios is an Audible and Visual Alert to warn the operator if the encryption key has failed when a coded transmission has begun.

Another standard feature found on all SECURENET equipped models is an alert tone to warn the operator when transmitting in the clear mode. This is active all the time.

CODE STORAGE (W268)

This option provides a lithium battery located on the common circuits board. The battery will supply power for code retention in the event of power loss to the radio.



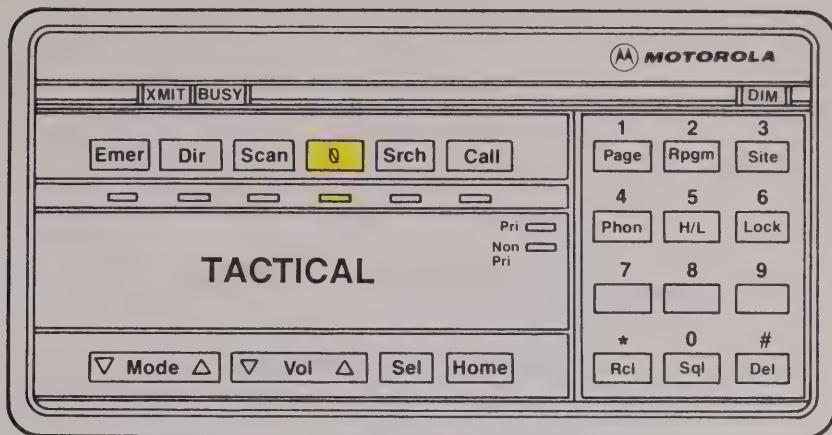


"DES-XL" EQUIPPED MODELS (W795)

DES stands for Data Encryption Standard and is a National Bureau of Standards encryption method for protecting all forms of digital communications. The encryption is performed by a DES-XL hybrid and is capable of accepting any one of 7.6×10^{16} different keys, all which are available from the handheld Key Variable Loader. DES-XL equipped radios will not communicate with DVP or DVP-XL equipped radios while in the encrypted mode. Dual Code is not available with DES-XL.

As with DVP-XL, all of the following functions are available for DES-XL through field programming:

- * On/Off Operation Control - either operator select or mode slaved .
- * Proper Code Detect - enabled or disabled.
- * Receive clear alert tone sounds when a clear signal is received and the SECURENET option is turned on.
- * System Security Monitor - disables the radio if the SECURENET code fails.
- * Echo Muting Time - large systems may require some delay time following Securenet transmissions to cancel echoes. This delay can be set from 0 to 750 milliseconds in 25 millisecond intervals. The default value is preselected at 0.0 seconds.
- * Squelch Sensitivity with Scan On - With this feature, during Securenet operation, scanning sensitivity improves when scanning for weak Securenet signals. When Securenet and scan are on, the squelch level overrides the operator selected level of squelch and changes to a predetermined setting of 1 (threshold) to 4 (tight). The squelch level may not be changed when scan is on. Squelch level returns to the operator selected value when scan is turned off.



The optional DES/DES-XL Security Housing (W391) provides a physically secure environment for DES-XL encryption circuitry. It includes locks to inhibit coded operation (both transmit and receive) and encryption key entry. It also features an anti-tamper switch that erases the encryption key when the housing is disassembled and an external key reset for operator controlled key erasure.

Physically the SECURENET circuitry is on a single circuit board located inside the security housing. The circuit board uses a microprocessor to perform the audio switching and control functions for the SYNTOR X 9000E radio system. The electronic encryption key loads into the SECURENET board through a six-pin connector located on the front of the security housing. The Operate/Standby, Key Erase, and Keyload switches are also on the front of the housing.

The Keyload switch has a dual purpose; it allows entry into the security housing and is used in conjunction with the six-pin keyload connector. The switch must be unlocked to allow an encryption key to be transferred to the radio. Entry into the housing is allowed in the keyload position.

The Operate/Standby switch allows the operator to set the system to operate only in standard mode. When this switch is in the Standby position, the radio operates in the standard mode only. When set to Operate, the [Q] button on the control unit selects between private (encrypted) or standard mode.

The Key Erase switch erases the electronic key and disables both encryption and decryption. This switch operates even if the radio is off. A second anti-tamper erase switch is contained inside the security housing. This switch erases the electronic key when the housing is disassembled.

PROGRAMMING EQUIPMENT

IBM and IBM Compatible Computer

Programming kits are available from National Parts Department which provide the necessary software and cables to use an existing IBM PC to field program the SYNTOR X 9000E radio.

Programmable conventional parameters include the ability to program frequencies, squelch codes, time-out timer, mode names, MDC-1200 unit ID numbers, button location, and all programmable options. Additional field programmable names include: Operator Select MPL, MDC-1200 Selective Call unit names, Status and Message names and DTMF/Telephone Interconnect target names.

Programmable trunking parameters include system, subfleet and mode names; "Call Alert" page and "Private Conversation" call target names and telephone interconnect names.

See the following pages for:

Service Aid List

Hardware and Software requirements

SERVICE AID LIST

SYNTOR X 9000E MOBILE RADIO

The following service aids are available through Motorola Communications & Electronics Parts to facilitate servicing of the SYNTOR X 9000E Mobile Radios. Please contact your Area Parts Manager for price and delivery.

FIELD PROGRAMMING ▼

Model No.	Description
	SYNTOR X 9000E RADIO SERVICE HARDWARE The 9000E Radio Service software is designed to operate on the IBM PC, XT, or AT family of computers. It is suggested that one of these computers be used as the Programmer. IBM DOS 2.0 or higher, an RS232 Asynchronous Serial Communication Adapter, and RAM memory of 512K bytes minimum are necessary for programming. The software and manuals provide the user with the capability to change the radio's frequencies, mode names and other radio parameters.

01-80353A74 RADIO INTERFACE BOX (RIB)
Voltage level shifter to enable communications between the radio and the computer's RS232 Serial Communication Adapter.

30-80369B71 IBM PC/XT COMPUTER INTERFACE CABLE
This 25 pin cable is used to connect the computer's RS232 Asynchronous Serial Communications Adapter to the RIB (01-80353A74).

30-80369B72 IBM PC-AT COMPUTER INTERFACE CABLE
This 9 pin cable is used to connect the computer's RS232 Asynchronous Serial Communications Adapter to the RIB (01-80353A74).

01-80353A75 RADIO INTERFACE ACCESSORY
RIB CABLE - Used to connect the radio to the RIB box (01-80353A74).

SERVICE MANUAL ▼

Model No.	Description
6880101W62	9000E SERVICE MANUAL

FIELD PROGRAMMING ▼

Model No.	Description
RPX-4719	SOFTWARE LICENSING PACKAGE Contains software licensing agreement, software ordering forms, and a list of available software. This kit must be ordered prior to ordering any software.
RVN-4010	9000E RADIO SERVICE SOFTWARE ON 3 1/2 IN. DISK - Operates on computers with 3 1/2 in. floppy disk drives.
RVN-4009	9000E RADIO SERVICE SOFTWARE ON 5 1/4 IN. DISK - Operates on computers with 5 1/4 in. floppy disk drives.

SERVICE TOOLS ▼

Model No.	Description
RSX-4057	HOT AIR BONDER For instantaneous pinpoint soldering and repairing of hybrid circuits. Provides precision controlled spot heating for fast and easy repairs.
RSX-4044	ADJUSTABLE TORQUE DRIVER SET WITH BITS
01-80320B16	MAGNETIC SCREWDRIVER SET WITH BITS
	INSERTION AND EXTRACTION TOOLS
66-80163F01	Used to remove VIP connectors from the control head.
66-80371B14	Chip carrier extraction tool for MDC-1200. (Required to change software).
39-84257L01	VIP CONNECTOR-FEMALE CONTACT
09-80080L01	SHORTING PIN

Support Services



SERVICE AID LIST

SYNTOR X 9000E MOBILE RADIO

The following service aids are available through Motorola Communications & Electronics Parts to facilitate servicing of the SYNTOR X 9000E Mobile Radios. Please contact your Area Parts Manager for price and delivery.

SPARE ACCESSORIES ▼

Model No.	Description
RPX-1028A	SPARE ACCESSORIES GROUP Provides all radio accessories including mounting plate. (Excludes antenna and manuals).
RPX-1027A	SECURE CAPABLE ACCESSORIES GROUP Provides all radio accessories for Secure Capable models including the mounting plate. (Excludes antenna and manuals).
H1142A	SPARE CONTROL HEAD
H1141A	8K MEMORY MODULE Provides programmed code plug (Requires trunking control number).
HKN4241A	RADIO POWER CABLE
HKN4256A	SECURE CAPABLE RADIO POWER CABLE

Support Services



"SYSTEMS 9000" BUTTON LIST

Standard SYSTEMS 9000 Control Head buttons shipped prior to JUNE 1987.

3880090J01 BLANK

J02 MPL
J03 Scan
J05 PA
J06 Siren
J07 Wail
J08 Hi-Lo
J09 Man
J10 H/L
J11 Sts
J12 Call
J13 Msg
J14 Rcl
J16 ExRd
J17 Del
J18 Sel
J20 DTMF
J21 Yelp
J22 MVS
J26 Emer
J28 F/R
J29 Alt
J31 Sql
J35 Pvt
J36 Site
J39 Home
J40 Menu
J41 Rpgm
J42 Step
J44 Phone
J45 Dir
J49 0
J50 L/S
J51 S/S
J52 Emer
J58 AirHn
J61 Srch
J62 Lock
J63 Page

3880253K01 PLUG

Continued Next Page

Continued "SYSTEMS 9000" Buttons

Standard "Systems 9000" Control Head buttons shipped on units after JUNE 1987. Selected buttons have bold graphics compared to prior JUNE 87 buttons.

3880043M01 BLANK

M02 MPL
M03 Scan
M05 PA
M06 Sirn
M07 Wail
M08 Hi-Lo
M09 Man
M10 H/L
M11 Sts
M12 Call
M13 Msg
M14 Rcl
M16 ExRd
M17 Del
M18 Sel
M20 DTMF
M21 Yelp
M22 MVS
M26 Emer
M27 Ext
M28 F/R
M29 Alt
M31 Sql
M35 Pvt
M36 Site
M39 Home
M40 Menu
M41 Rpgm
M42 Step
M44 Phon
M45 Dir
M49 0
M50 L/S
M51 S/S
M52 Emer
M58 AirHn
M61 Srch
M62 Lock
M63 Page

3880253K01 PLUG

Continued Next Page

Mode & Volume Rocker Button List

3880091J07	BOLD GRAPHICS	SYS
J06	BOLD GRAPHICS	SUB
J05	STD GRAPHICS	Zone
J04	BOLD GRAPHICS	Vol
J03	BOLD GRAPHICS	Mode
J02	STD GRAPHICS	Volume
J01	STD GRAPHICS	Mode

Direct Entry Keyboard buttons

3880156L01	BLANK
L02	MSG 1
L03	MSG 2
L04	MSG 3
L05	MSG 4
L06	MSG 5
L07	MSG 6
L08	MSG 7
L09	MSG 8
L18	STS 1
L19	STS 2
L20	STS 3
L21	STS 4
L22	STS 5
L23	STS 6
L24	STS 7
L25	STS 8
L34	Siren
L35	PA
L36	Yelp
L37	Wail
L38	Hi-Lo
L39	Man
L40	ExRd
L41	ArHn

"SMARTNET" SYSTEM

"SECURENET" DIGITAL CAPABLE "SYNTOR X 9000E" MOBILE

RADIO

Option Table

OPTION	DESCRIPTION	INCOMPATIBLE OPTIONS
TRUNKING OPTIONS		
W829	8 SYS/16 SUB/64 MODE	W306,W305,W238,W709
W306	15 SYS/16 SUB/8 MODE	W305,W709,W829,W238
W305	16 SYS/8 SUB/64 MODE	W306,W709,W829,W238
W709	25 SYS/8 SUB/32 MODE	W306,W305,W238,W829
W821	WIDE AREA COVERAGE	W238
W822	DYNAMIC REGROUPING	W238
W820	SELECTABLE PC/CA	W238
W20	TELE INTERCONNECT	W238
W826	OMIT EMER ALARM	W238,W470,W688
W238	OMIT TRUNKING	W20,W354,W373,W374,W709, W820,W821,W355,W997,W829, W822,W306,W346,W996,W826, W305
CONVENTIONAL OPTIONS		
W814	MDC-1200 PTT/ID/EMER	W827,W412
W412	MDC-1200 SEL CALL	W827,W814
W688	HIDDEN PUSHBUTTON	W827,W826
W470	HIDDEN FOOTSWITCH	W827,W826
W946	DTMF/TELE INTERCONNECT	W827
W827	OMIT CONV OPERATION	W941,W946,W370,W355,W814, W412,W374
TRUNKED/CONVENTIONAL OPTIONS		
W370	MDC 8 STS/MESG DEK	W941,W827,W374,W373,W355, W354
W354	TRUNKED 8 STS/MESG DEK	W238,W355,W941,W354,W373, W374
W355	MDC/TRNK 8 STS/MESG DEK	W354,W373,W374,W941,W370, W238,W827
W941	MDC 8 STS/8 MESG DEK	W370,W827,W373,W374,W355, W354
W373	TRUNKED 8 STS/8 MESG DEK	W355,W354,W238,W374,W941, W370
W374	MDC & TRNK 8 STS/8 MESG DEK	W373,W355,W354,W238,W941, W370,W827

OPTION	DESCRIPTION	INCOMPATIBLE OPTIONS
W269	SIREN/PA	W589,W90,W125
W589	PA	W269,W90,W125
W591	AUX SWITCH PANEL	W90
W995	ZONE/MODE CONTROL HEAD	W90,W996
W996	SYS/SUB CONTROL HEAD	W995,W90,W238
W116	EXTERNAL ALARM	W90

EXTERNAL OPTIONS

W239	NOISE CANCELLING MIC	W109,W71,W90
W109	HANDSET W/HANGUP	W239,W71,W90
W58	1/4 WAVE ANTENNA	W70,W90
W101	22 FT CABLE	W391,W674,W78,W90
W70	OMIT ANTENNA	W58,W90
W71	OMIT MICROPHONE	W239,W109,W90
W87	OMIT SPEAKER	W90
W90	OMIT ACCESSORIES	ALL EXTERNAL OPTIONS
W125*	OPTION EXPANSION INTERFACE KIT	W269,W589

"SECURENET" OPTIONS

W797	DVP-XL	W795
W795	DES-XL	W797
W391	PHYSICAL SECURITY	W101
W268	CODE STORAGE	
W304	PROPER CODE DETECT	
W674	PHYSICAL SECURE CABLE	W101
W78	ALTERNATE LENGTH CABLE	W101

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* THE RADIO UNIT IS CAPABLE OF HOUSING ONE "SYSTEMS 9000" OPTION BOARD ONLY. IF MORE THAN ONE OPTION IS ORDERED WHICH REQUIRES AN OPTION BOARD, THEN AN OPTION EXPANSION INTERFACE KIT IS REQUIRED. THIS KIT IS NOT REQUIRED IF SIREN/PA IS ORDERED.

THE FOLLOWING IS A SUMMERY OF THE OPTIONS WHICH REQUIRE OPTION BOARDS, AS WELL AS THE EXTERNAL HOUSINGS TO HOUSE THEM :

OPTIONS	BOARDS REQUIRED
1. CONVENTIONAL SEL CALL: W412	1
2. PTT/ID EMERGENCY: W814	1
3. ANY STATUS MESSAGE OPTION (UNLESS W412 OR W814 IS ORDERED)	1
4. ANY "SECURENET" ENCRYPTION	1
5. DTMF/TEL INTERCONNECT: W496	1
6. OMIT TRUNKING (DELETES ONE BOARD): W238	- 1

EXTERNAL HOUSINGS	BOARD COMPATIBILITY
1. SIREN/PA: W589	2
2. PA: W269	2
3. PHYSICAL SECURITY: W391 ("SECURENET" ENCRYPTION ONLY)	1
4. OPTION EXPANSION INTERFACE KIT: W125	2

SYNTOR X 9000 Conventional Radio

"SYSTEMS 9000" BUTTON MENU

[DIM]	DIMMER BUTTON
[Emer]	EMERGENCY
[Dir]	DIRECT (TALK AROUND)
[MPL]	OPERATOR SELECT MULTIPLE "PRIVATE-LINE"
[Scan]	OPERATOR SELECT/MODE SELECT "CHANNEL SCAN"
[Ø]	"SECURENET"
[PA]	PUBLIC ADDRESS
[Sirn]	SIREN ACTIVATION
[Wail]	SIREN SOUND
[Yelp]	SIREN SOUND
[Hi-Lo]	SIREN SOUND
[Man]	MANUAL (EXTERNAL SIREN ACTIVATION)
[ExRd]	EXTERNAL RADIO (EXTERNAL AUDIO)
[H/L]	HORN & LIGHTS
[MVS]	MOBILE VOICE STORAGE
[Sts]	STATUS
[Msg]	MESSAGE
[Call]	CALL (DTMF & "MDC SEL CALL")
[Phon]	TELEPHONE INTERCONNECT
[Rcl]	RECALL
[Sql]	SQUELCH
[Del]	DELETE
[Home]	HOME
[Sel]	SELECT
[Vol]	VOLUME
[Mode]	MODE SELECT

SYNTOR X 9000E SMARTNET Radio

"SYSTEMS 9000" BUTTON MENU

[DIM]	DIMMER CONTROL
[Emer]	EMERGENCY
[Dir]	DIRECT (TALK AROUND)
[MPL]	OPERATOR SELECT MULTIPLE "PRIVATE-LINE"
[Scan]	OPERATOR SELECT/MODE SLAVED "CHANNEL SCAN"
[Ø]	"SECURENET"
[Srch]	SYSTEM SEARCH AND LOCK
[H/L]	HORN & LIGHTS
[Call]	CALL (DTMF, "MDC SEL CALL", & "PRIVATE CONVERSATION")
[Page]	PAGE ("CALL ALERT")
[Phon]	TELEPHONE INTERCONNECT (DTMF & TRUNKING)
[Rpgm]	REPROGRAM ("DYNAMIC REGROUPING")
[Site]	AUTOMATIC MULTIPLE SITE SWITCHING-AMSS
[Lock]	AUTOMATIC MULTIPLE SITE SWITCHING-AMSS
[Rcl]	RECALL
[Sql]	SQUELCH
[Del]	DELETE
[Home]	HOME
[Sel]	SELECT
[Vol]	VOLUME
[Mode]	MODE SELECT
[SYS]	SYSTEM SELECT
[SUB]	SUBFLEET SELECT
[Zone]	ZONE SELECT
[F/R]	FRONT/REAR CONTROL UNIT SELECT

CONTINUED NEXT PAGE

SYNTOR X 9000E Radio
"SYSTEMS 9000" BUTTON MENU

DIRECT ENTRY

[Siren]	SIREN ACTIVATION
[Wail]	SIREN SOUND
[Yelp]	SIREN SOUND
[Hi-Lo]	SIREN SOUND
[ArHn]	AIRHORN SOUND
[Man]	MANUAL (EXTERNAL SIREN ACTIVATION)
[PA]	PUBLIC ADDRESS
[ExRd]	EXTERNAL RADIO (EXTERNAL AUDIO)
[Sts1]	STATUS 1
[Msg1]	MESSAGE 1

SECURENET Digital Capable SYNTOR X 9000

Option Table

MODEL/ OPTION	DESCRIPTION	INCOMPATIBLE OPTIONS
T99KX036W	SX 9000 HB 40W	W123,W124
T99KX037W	SX 9000 HB 100W	W123,W124
T99KX038W	SX 9000 UHF 30W	W544,W577,W578
T99KX039W	SX 9000 UHF 78W	W555,W577,W578
T99KX040W	SX 9000 UHF 100W	W123,W124,W544,W577,W578
W988	LIMITED CONTROL HEAD	ALL OPTIONS NOT MARKED (+)
W844(+)	PLANT PROGRAMMING	
W425	REPEATER TALK AROUND	W90
W930	64 MODE OPERATION	W983,W984
W290	OPERATOR SELECT MPL	W90
CHANNEL SCAN		
W495	MODE SELECT SCAN	W90,W929
W421	TWO LEVEL PRIORITY	W90,W929
W703	TALK BACK SCAN	W90,W929
W929	OMIT SCAN	W90,W421,W495,W703
W946	DTMF/TELE INTERCONNECT	
W116	EXTERNAL ALARM	W90,W681
MDC-600 SIGNALING		
W452	UNIT ID AND EMERGENCY ALERT	W20*,W90,W712,W681,W824,W825,W983,W984
W681	SELECTIVE CALL ENCODE/DECODE	W20*,W90,W452,W116
W824	STATUS	W20*,W90,W452,W983,
W825	MESSAGE	W20*,W90,W452,W984
W873	EMER BUTTON CONTROL HEAD	W90
W688	EMER HIDDEN BUTTON	W90,W470
W470	EMER HIDDEN FOOT SWITCH	W90,W688
W983	DIRECT ENTRY STATUS	W20*,W90,W452,W984,W824,W930
W984	DIRECT ENTRY STATUS/MESG	W20*,W90,W452,W983,W825,W930
W712	MOBILE VOICE STORAGE	W20*.W90,W452
W269	SIREN/PA	W90,W589
W589	PA	W90,W269
W591(+)	AUXILIARY SWITCH PANEL	W90
INTERNAL OPTIONS		
W12(+)	RF PREAMPLIFIER	
W11(+)	TIME-OUT-TIMER	W428
W428	VARIABLE T-O-T	W11
W427	AND SQUELCH	

OPTION	DESCRIPTION	INCOMPATIBLE OPTION
EXTERNAL OPTIONS		
W20(+)	DTMF MICROPHONE	W71,W90,W109,W239,
W109(+)	HANDSET	W20,W239,W90,W71
W239(+)	NOISE CANCEL MIC	W20,W109,W90,W71
W71(+)	OMIT MICROPHONE	W20,W109,W90,W239
W496	10FT. CABLE	W90,W101,W674,W391,W78
W101	22 FT. CABLE	W90,W496,W674,W391,W78
W87(+)	OMIT SPEAKER	W90
W544(+)	VHF BASE LOADED ROOFTOP ANT.	W70,W90,W578,W577,W123,W124
W578(+)	VHF COAXIAL SIDE MOUNT ANT.	W70,W90,W544,W577,W123,W124
W577(+)	VHF COAXIAL BUMPER MOUNT ANT.	W70,W90,W544,W578,W123,W124
W123(+)	UHF 3.5 DB GAIN ANTENNA	W70,W90,W544,W578,W577,W124
W124(+)	UHF 5 DB GAIN ANTENNA	W70,W90,W544,W578,W577,W123
W70	OMIT VHF ANTENNA	W90,W544,W578,W577,W123,W124
W90	OMIT ALL ACCESSORIES	ALL OPTIONS EXTERNAL TO RADIO
W125**	OPTION EXPAN. INTERFACE KIT	W90,W269,W589

SECURENET

W388	DES	W794,W797,W795,W303
W795	DES-XL	W388,W794,W797,W303
W794	DVP	W388,W797,W795,W391
W797	DVP-XL	W388,W794,W795,W303
W391	PHYSICAL SECURITY	W101,W794
W268	CODE STORAGE	
W304	PROPER CODE DETECT	
W303	DUAL CODE SELECT	W797,W388,W795
W674	PHYSICAL SECURITY CABLING	W794,W101
W78	ALTERNATE LENGTH SEC CABLING	W794,W101

* CONTACT YOUR ASE FOR COMPATIBILITY

** THIS OPTION IS REQUIRED WHEN ORDERING MORE THAN 2 SYSTEMS 9000 OPTIONS WHICH REQUIRE OPTION BOARDS. THE FOLLOWING OPTIONS REQUIRE OPTION BOARDS:

1. MDC-600 SEL CALL (W681) OR PTT ID & EMERGENCY (W452)
2. ANY STATUS / MESSAGE OPTION (UNLESS W452 OR W681 IS ORDERED)
3. DTMF / TELEPHONE INTERCONNECT (W946)
4. MOBILE VOICE STORAGE (W712)
5. SECURE VOICE OPTIONS

EXTERNAL HOUSING IS NOT REQUIRED IF SIREN/PA IS ORDERED.

THE FOLLOWING COMBINATION OF OPTIONS CANNOT BE ORDERED DUE TO THE LIMITED SPACE ON THE CONTROL HEAD INDICATOR PANEL:

W425 REPEATER TALK AROUND
W290 MULTIPLE CODED SQUELCH
W269 SIREN / PA
W946 DTMF / TEL INTERCONNECT
ANY SECURITY ENCRYPTION OPTION

SMARTNET

SECURENET Digital Capable SYNTOR X 9000E

Option Table

OPTION	DESCRIPTION	INCOMPATIBLE OPTIONS
TRUNKING OPTIONS		
W829	8 SYS/16 SUB/64 MODE	W306,W305,W238,W709
W306	15 SYS/16 SUB/8 MODE	W305,W709,W829,W238
W305	16 SYS/8 SUB/64 MODE	W306,W709,W829,W238
W709	25 SYS/8 SUB/32 MODE	W306,W305,W238,W829
W821	WIDE AREA COVERAGE	W238
W822	DYNAMIC REGROUPING	W238
W820	SELECTABLE PC/CA	W238
W20	TELE INTERCONNECT	W238
W826	OMIT EMER ALARM	W238,W470,W688
W238	OMIT TRUNKING	W20, W354,W373,W374,W709, W820,W821,W355,W997,W829, W822,W306,W346,W996,W826, W305
CONVENTIONAL OPTIONS		
W814	MDC-1200 PTT/ID/EMER	W827,W412
W412	MDC-1200 SEL CALL	W827,W814
W688	HIDDEN PUSHBUTTON	W827,W826
W470	HIDDEN FOOTSWITCH	W827,W826
W946	DTMF/TELE INTERCONNECT	W827
W827	OMIT CONV OPERATION	W941,W946,W370,W355,W814, W412,W374
TRUNKED/CONVENTIONAL OPTIONS		
W370	MDC 8 STS/MESG DEK	W941,W827,W374,W373,W355, W354
W354	TRUNKED 8 STS/MESG DEK	W238,W355,W941,W354,W373, W374
W355	MDC/TRNK 8 STS/MESG DEK	W354,W373,W374,W941,W370, W238,W827
W941	MDC 8 STS/8 MESG DEK	W370,W827,W373,W374,W355, W354
W373	TRUNKED 8 STS/8 MESG DEK	W355,W354,W238,W374,W941, W370
W374	MDC & TRNK 8 STS/8 MESG DEK	W373,W355,W354,W238,W941, W370,W827

OPTION	DESCRIPTION	INCOMPATIBLE OPTIONS
W269	SIREN/PA	W589, W90
W589	PA	W269, W90
W591	AUX SWITCH PANEL	W90
W995	ZONE/MODE CONTROL HEAD	W90, W996
W996	SYS/SUB CONTROL HEAD	W995, W90, W238
W116	EXTERNAL ALARM	W90

EXTERNAL OPTIONS

W239	NOISE CANCELLING MIC	W109, W71, W90
W109	HANDSET W/HANGUP	W239, W71, W90
W58	1/4 WAVE ANTENNA	W70, W90
W101	22 FT CABLE	W391, W674, W78, W90
W70	OMIT ANTENNA	W58, W90
W71	OMIT MICROPHONE	W239, W109, W90
W87	OMIT SPEAKER	W90
W90	OMIT ACCESSORIES	ALL EXTERNAL OPTIONS
W125*	OPTION EXPANSION INTERFACE KIT	

SECURENET OPTIONS

W794	DVP	W391, W797, W388, W795
W388	DES	W795, W794, W797
W797	DVP-XL	W794, W795, W388
W795	DES-XL	W388, W794, W797
W303	DUAL CODE	W797, W795, W388
W391	PHYSICAL SECURITY	W101, W794
W268	CODE STORAGE	
W304	PROPER CODE DETECT	
W674	PHYSICAL SECURE CABLE	W794, W101
W78	ALTERNATE LENGTH CABLE	W794, W101

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* THE RADIO UNIT IS CAPABLE OF HOUSING ONE "SYSTEMS 9000E" OPTION BOARD ONLY. IF MORE THAN ONE OPTION IS ORDERED WHICH REQUIRES AN OPTION BOARD, THEN AN EXTERNAL HOUSING IS REQUIRED. THE FOLLOWING IS A SUMMERY OF THE OPTIONS WHICH REQUIRE OPTION BOARDS, AS WELL AS THE EXTERNAL HOUSINGS TO HOUSE THEM:

OPTIONS	BOARDS REQUIRED
1. CONVENTIONAL SEL CALL: W412	1
2. PTT/ID EMERGENCY: W814	1
3. ANY STATUS MESSAGE OPTION (UNLESS W412 OR W814 IS ORDERED)	1
4. ANY SECURENET ENCRYPTION	1
5. DTMF/TEL INTERCONNECT: W496	1
6. OMIT TRUNKING (DELETES ONE BOARD): W238	- 1

EXTERNAL HOUSINGS	BOARDS REQUIRED
1. SIREN/PA: W589	2
2. PA: W269	2
3. PHYSICAL SECURITY: W391 ("SECURENET" ENCRYPTION ONLY)	1
4. OPTION EXPANSION INTERFACE KITS: W125	2



MOTOROLA INC.

Communications
Sector

MODEL L35VLB5174BMSP06
ADVANCED TRUNKED SYNTOR X™
FM TWO-WAY CONTROL STATION
INSTRUCTION MANUAL

ATTACHMENTS

-- Commercial Warranty and Computer Software Copyrights Section	68P81112E94
-- General Safety Information	EPS-28750
-- Model Complement Table	Page 4
-- Special Options Table	Page 5
-- Standard Options Table	Page 5
-- Performance Specifications	Page 6
-- Advanced Trunked SYNTOR X FM Two-Way Control Station Instruction Manual	1S-SP5290317
-- Trunked SYNTOR X SMARTNET™ Dual Operation FM Two-Way Radio Instruction Manual	68P81066E80

technical writing services

1301 E. Algonquin Road, Schaumburg, IL 60196

COMMERCIAL WARRANTY (STANDARD)

Motorola radio communications products are warranted to be free from defects in material and workmanship for a period of ONE (1) YEAR, [except for crystals and channel elements which are warranted for a period of ten (10) years] from the date of shipment. Parts, including crystals and channel elements, will be replaced free of charge for the full warranty period but the labor to replace defective parts will only be provided for One Hundred-Twenty (120) days from the date of shipment. Thereafter purchaser must pay for the labor involved in repairing the product or replacing the parts at the prevailing rates together with any transportation charges to or from the place where warranty service is provided. This express warranty is extended by Motorola Communications and Electronics, Inc., 1301 E. Algonquin Road, Schaumburg, Illinois 60196, to the original purchaser only, and only to those purchasing for purpose of leasing or solely for commercial, industrial, or governmental use.

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED WHICH ARE SPECIFICALLY EXCLUDED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

In the event of a defect, malfunction or failure to conform to specifications established by seller, or if appropriate, to specifications accepted by Seller in writing, during the period shown, Motorola, at its option, will either repair or replace the product or refund the purchase price thereof, and such action on the part of Motorola shall be the full extent of Motorola's liability hereunder.

This warranty is void if:

- a. the product is used in other than its normal and customary manner;
- b. the product has been subject to misuse, accident, neglect or damage;
- c. unauthorized alterations or repairs have been made, or unapproved parts used in the equipment.

This warranty extends only to individual products, batteries are excluded, but carry their own separate limited warranty. Because each radio system is unique, Motorola disclaims liability for range, coverage, or operation of the system as a whole under this warranty except by a separate written agreement signed by an officer of Motorola.

Non-Motorola manufactured products are excluded from this warranty but subject to the warranty provided by their manufacturers, a copy of which will be supplied to you on specific written request.

In order to obtain performance of this warranty, purchaser must contact its Motorola salesperson or Motorola at the address first above shown, attention Quality Assurance Department.

This warranty applies only within the United States.

EPS-27734-O

COMPUTER SOFTWARE COPYRIGHTS

The Motorola products described in this instruction manual may include copyrighted Motorola computer programs stored in semiconductor memories or other media. Laws in the United States and other countries preserve for Motorola certain exclusive rights for copyrighted computer programs, including the exclusive right to copy or reproduce in any form the copyrighted computer program. Accordingly, any copyrighted Motorola computer programs contained in the Motorola products described in this instruction manual may not be copied or reproduced in any manner without the express written permission of Motorola. Furthermore, the purchase of Motorola products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Motorola, except for the normal non-exclusive, royalty free license to use that arises by operation of law in the sale of a product.

EPS-34440-B

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MOTOROLA INC.
Communications
Sector

GENERAL SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to the use of this equipment. Proper use of this radio will result in exposure below the OSHA limit. The following precautions are recommended:

DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of a fixed radio (base station, microwave and rural telephone rf equipment) or marine radio when someone is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of any radio unless all RF connectors are secure and any open connectors are properly terminated.

In addition,

DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly grounded according to Motorola installation instructions for safe operation.

All equipment should be serviced only by a qualified technician.

Refer to the appropriate section of the product service manual for additional pertinent safety information.

EPS-28750-A

MODEL COMPLEMENT TABLE
MODEL L35VLB5174BMSP06

KIT NUMBER	DESCRIPTION
HLN1186A	Code Plug
HLN4938B	EEPROM Board
HLN4771A	PROM 16-Mode
HLN4243A	Bottom Cover
HLN4263A	Top Cover
HLN4667A	Mounting Tray
YUF1003B	Trunked 10 W Unified Chassis
HKN4156A	10W Cable
HLN4217A	Feed Through Plate
HLN4259A	Front Panel Hardware
HLN4745A	PL/DPL Board
HLN4746A	Hardware Kit
HLN4920A	Advanced Personality Board
YLN4341B	Radio EPROM
TLN2277A	Internal RF Talk Around Casting
TRN4405A	VCO Talk Around
TRN8868A	Pre-Amplifier
TRN8869A	Mixer
TRN8871B	VCO Buffer
TRN8872A	VCO Interconnect
TRN8873A	Internal Casting and Hardware
TRN4274A	Filter Board
TRN4734A	Antenna Switch
TRN4775A	Power Amplifier Hardware
TRN8850A	Hybrid Filter Hardware
TRN8851A	Intermediate Power Amplifier Hybrid
TRN8852A	IPA Predriver Hybrid
TRN8853A	IPA Driver 20W Hybrid
TRN8855A	Metering Board
TRN8856A	Directional Detector Hybrid
TRN8857A	Directional Coupler
TRN8860A	RF Board
TRN8862A	Common Circuits Board
THN6401A	Trunked Control Housing
YRN4003A	Chassis and Panel Remote Control
TRN4513A	Tuning Tool
TPN1197A	Power Supply
TPN6147A	Regulator Board
TRN5497A	Heat Sink
YLN4339A	Intercom Board

SPECIAL OPTIONS TABLE

OPTION	DESCRIPTION
L443AA-SP	Provides up to 8 subfleet select capability
L336AD-SP	Provides up to 15 subfleet select capability
L185AC-SP	Deletes emergency call
L444AA-SP	Deletes conventional channel capability
L447AB-SP	Provides up to a maximum of 15 trunked systems and 10 conventional channels
L445AB-SP	Provides maximum of 8 trunked and conventional systems
L446AB-SP	Provides maximum of 16 trunked and conventional systems
L448AA-SP	Call Alert™ page decode
L449AA-SP	Call Alert page encode
L441AB-SP	Unlimited Call Alert page encoder
L451AA-SP	Single Private Conversation™ call
L452AA-SP	Multiple Private Conversation call
L440AC-SP	Unlimited Private Conversation II™ call (includes unlimited Call Alert page encode
L458AA-SP	For use on an Automatic Multiple Switching (AMAX) System
L456AB-SP	Provides the capability for the radio to be dynamically regrouped
L11AD-SP	Provides a 60 second time-out timer when transmitting on a conventional channel
L453AA-SP	Provides a selectable time-out timer for each conventional channel
L42AF-SP	Adds preprogrammed trunking scan
L837AA-SP	Extended Warranty Agreement
L461AB-SP	Test and Optimization Console™ Radio

STANDARD OPTIONS TABLE

OPTION	DESCRIPTION
L328AA	Provides operation at 100 V AC, 50/60 Hz
L329AA	Provides operation at 200 V AC, 50/60 Hz
L305AA	Provides operation at 240 V AC, 50/60 Hz
L32AG	Provides operation at 12 V DC only
L273AC	Permits wall mount

PERFORMANCE SPECIFICATIONS

GENERAL

Model No.	L35VLB5174BMSP06
Frequency	806.0125-870 MHz
Maximum RF Output Power	10 W
Input Voltage	120 Vac @ 60 Hz (100/220/240 Vac Opt.) (12 V dc Opt.)
AC Current Drain (@ 121 V ac, 60 Hz)	Standby: 0.25A Transmit: 2A
DC Current Drain (@ 13.6 V dc)	Standby: 1.2A Transmit: 7A
No. of Channels or Frequency Pairs	5 to 20 (Trunked System) 0 to 10 (Conventional)
Dimensions (175mm x 425mm x 565mm)	6-7/8" H x 16-3/4" W x 22-1/4" L
Weight	Approximately 53 lb (24 kg) Shipping weight, including accessories; approximately 57 lb (28 kg)

TRANSMITTER (806.0125-870 MHz)

RF Power Drain	Variable from 3 W to 10 W
Output Impedance	50 ohms
Spurious and Harmonic Emissions	More than 70 dB below carrier (for EIA Spec., RS152B)
Frequency Stability	$\pm 0.0002\%$ from -30°C to $+60^{\circ}\text{C}$ ambient $+25^{\circ}\text{C}$ ref. $\pm 15\%$ primary voltage variation
Maximum Frequency Separation	19 MHz
Modulation	15F2 and 16F3; ± 5 kHz for 100% modulation @ 1000 Hz
Audio Sensitivity	0.080 V ± 3 dB for 60% max. deviation @ 1000 Hz
Audio Response	+1, -3 dB of 6 dB/octave pre-emphasis characteristic from 300 to 3000 Hz
Audio Distortion	Less than 2% @ 1000 Hz, 60% maximum deviation
FCC Designation	CC5031 - licensable under FCC Rules Part 90 for 15F2, 16F3 and 16F9 emissions

PERFORMANCE SPECIFICATIONS (continued)

RECEIVER (851.0125-870 MHz)

Channel Spacing	25 kHz
EIA Modulation Acceptance	±7 kHz
Selectivity	-80 dB @ ±25 kHz
-- EIA SINAD --	-90 dB @ ±100 kHz
Frequency Stability	Within ±.0002% from -30°C to +60°C @ 25°C ref. ±15% voltage variation
Input Impedance	50 ohms
Sensitivity	
-- 20 dB Quieting --	0.35 uV
-- EIA SINAD --	0.25 uV
Intermodulation	
-- EIA SINAD --	-80 dB
Spurious & Image Rejection	-100 dB
Audio Characteristics for Local Speaker Output	5 W @ 16 ohms
Response	+2, -8 dB of 6 dB/octave de-emphasis characteristic from 300 to 3000 Hz
Distortion	Less than 5% at 1000 Hz
Maximum Frequency Separation	19 MHz
FCC Designation	RC0246



MOTOROLA INC.
Communications
Sector

MODEL L35VLB5174BMSP06
ADVANCED TRUNKED SYNTOR X™
FM TWO-WAY CONTROL STATION
INSTRUCTION MANUAL

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technical writing services

1301 E. Algonquin Road, Schaumburg, IL 60196

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NOTE

The Microcomputer System section W10001S98 (p/o instruction manual 68P81066E80) is applicable except that Code Plug Board HLN1186A Schematic Diagram, Circuit Board Detail, and Parts List Motorola No. PW-3306, and Trunked Personality Board HLN4920A Schematic Diagram, Motorola No. 14-SP5290317, are the only schematics, circuit board details, and parts lists for the code plug board and personality board applicable to this control station.

NOTE

Refer to instruction manual 68P81066E80 for information pertaining to the Microcomputer System, Frequency Synthesizer, Receiver, and Common Circuits Board used with the -BMSP06 Trunked Control Station.

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2. DESCRIPTION

2.1 TRUNKED SYSTEM DESCRIPTION

2.1.1 Introduction

The 800 MHz Advanced Trunked *Syntor X* Communications System consists of control stations, mobile units, base repeaters, and a system central controller. (The term "trunking" essentially means the "automatic sharing" of a group of communications paths (trunks) among a large number of users.) The 800 MHz Advanced Trunked *Syntor X* Communication System provides a variety of features and capabilities many of which cannot be obtained in conventional systems. The features can be broken down into the following major categories:

- system capabilities
- system user capabilities
- system reliability capabilities
- system access features
- system expansion features

2.1.2 System Capabilities

FCC Docket No. 18262 stipulates that users or system operators needing six or more channels in the 800 MHz spectrum will be required to operate trunked systems. Moreover, trunked systems from a minimum of 5 channels to a maximum of 20 channels are authorized. Motorola's basic trunked system consists of 5 channels but is provided with the built-in capability of being expandable up to 20 channels.

2.1.3 User Call Capabilities

2.1.3.1 Subfleet Calls

The subfleet call is the basic element that is served by the Advanced Trunked *Syntor X* Communications System and is the standard call capability. A subfleet call allows all the radio units to monitor and initiate transmissions within that subfleet only. This provides the effect of a private channel down to the subfleet call.

2.1.3.2 Fleet Call (if requested)

This option allows the user of a Motorola Advanced Trunked *Syntor X* Communication System to initiate communication with all members of the fleet simultaneously without regard to subfleet boundaries. The unit will monitor any subfleet call made within the fleet on a FIFO (first-in-first-out) basis. Fleet privacy is insured since no two fleets would ever be assigned the same voice channel at the same time, thus making it impossible for any units in one fleet to interfere with those of another fleet. This eliminates the need to monitor other users before starting transmissions. (See Figure 1 for a typical fleet/subfleet configuration.)

An optional selector switch allows mobile units of the same fleet to selectively move between subfleets within the fleet. Moreover, the dispatchers (and select mobile stations) can be given both fleet-call and subfleet-call capabilities. Fleet call in a subdivided fleet allows the dispatcher (control station) or mobile operator to transmit a message to all the units in his fleet without regard for subfleet boundaries.

The fleet and subfleet selections are made via the subfleet selector switch on the mobile units and via the Extended Local Desk Set on the control station. The basic control station can be programmed either to operate within a specified subfleet or be given the fleet call capability such that its transmissions would be heard in all subfleets, and its receiver would monitor activity in all subfleets on a FIFO basis.

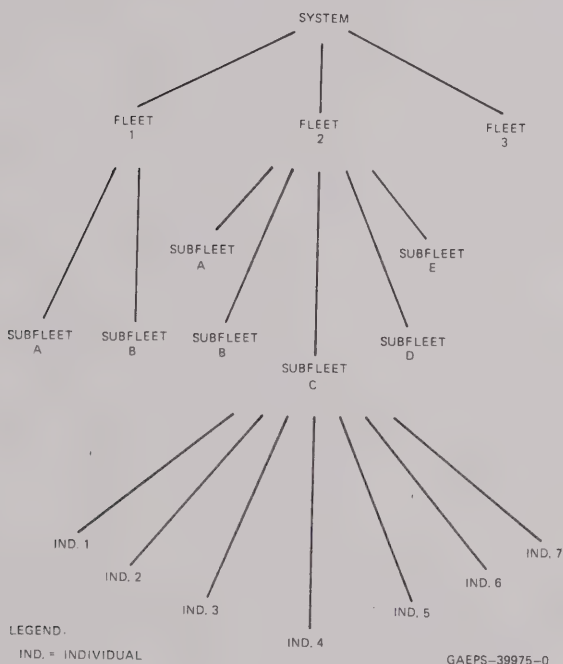


Figure 1. Typical Fleet/Subfleet Configuration

A trunked control station equipped for multiple subfleet operation receives only one subfleet at a time. Consequently, if the dispatcher selects one subfleet, he will not receive calls originating in a different subfleet. The same holds true for fleet call operations. If there is simultaneous operation in different subfleets, a trunked control station placed in the fleet-call mode will receive only one subfleet, since the control station receives the subfleets on a FIFO basis. Multiple control stations allow the dispatcher to hear calls in more than one subfleet simultaneously.

2.2 SYSTEM RELIABILITY -- MULTIPLE CHANNELS

2.2.1 The multi-channel aspect of the Motorola Advanced Trunked *Syntor X* Communications System provides a high degree of system reliability. Since channels are assigned as needed and no user is dependent on any given channel for his communications, the failure of any one channel will probably not be apparent to the users.

2.2.2 When a channel fails, the system central controller is programmed to assign only the working channels. Only during the busiest periods of the system would the users notice heavier-than-normal channel loadings and longer user access times caused by the loss of a channel.

2.3 BACK-UP CONTROL CHANNELS

The failure of an individual channel would not (in most cases) lead to a degradation of system performance. If the control channel fails, however, the whole system could go off the air. To prevent this, the system central controller is programmed to assign one of the voice channels as a substitute control channel. Under such conditions, the control station will recognize the new control channel and system operation will proceed without interruption.

2.4 RECEIVER INTERFERENCE

A trunked repeater may be jammed by the receipt of an unauthorized signal. The controller is programmed to turn off the repeater whenever it detects a carrier on a channel that has not been assigned to members of the system. The repeater will be re-assigned only when the unwanted carrier is removed.

2.5 TRANSMITTER FAILURE

The system central controller is programmed to detect any loss or reduction in the output power of any of the repeater transmitters. When the transmitter output power falls below a certain level, the channel will be automatically taken out of service.

2.6 SYSTEM SELF-DIAGNOSTICS

The system self-diagnostics comprise system central controller checks, repeater receiver interface checks, and repeater transmitter interface checks. The detection of a fault can trigger visual and/or audible alarms at the controller site. Relays are used for implementing these alarm functions.

2.7 FAILSOFT

2.7.1 A failsoft feature has been incorporated into the system to insure continued communications whenever the system central controller develops a fault. When the controller becomes inoperative, the mobile or control station units will automatically revert to their preassigned failsoft channels (system voice channels) and will be capable of conventional repeater operation on these channels. Once in the failsoft mode, however, the system will lose most of its fleet and subfleet privacy, but this privacy will be resumed as soon as normal system operation is restored.

2.7.2 A subaudible data handshake is activated on each voice channel whenever the repeaters go into the failsoft mode. This will insure that the mobile units will not operate in the failsoft mode simply because they went out of range of the central controller. Thus the mobile units will remain operative as long as they receive the subaudible data.

2.7.3 Since failsoft channel assignments are a function of the mobile unit or control station code plug, they must be specified at the time of code plug programming. These assignments are made such that all the system mobile units are evenly distributed over the system voice channels. Members of the same fleet or subfleet should be assigned to the same channel. Mobile units can be denied failsoft operation via the code plug if desired.

3. SYSTEM ACCESS FEATURES

3.1 BUSY TONES

There will be times when all the channels in the trunked communications system are busy. Since it is not possible to monitor other users on a trunked system, control station operators will be provided with telephone-type busy tone. Any user depressing his PTT pushbutton while the system channels are busy will receive a busy tone.

3.2 BUSY QUEUE/CALL BACK

Users requesting system access at a time when all voice channels are in use will be put in a waiting queue and will be served on a FIFO basis. When a channel becomes free, the system controller will send a call back tone to the first mobile or control station unit in the waiting queue. The call back consists of a short series of beeping tones which can be heard by the operator. This feature permits the operator who receives a busy indication to release his PTT pushbutton and wait for the call back signal rather than keep on repeatedly depressing his PTT pushbutton in an attempt to access a system channel.

3.3 TALK-PERMIT TONE (OPTIONAL)

This feature provides a control station operator with a brief (200 ms) series of tones whenever he keys up a voice channel. The talk-permit tones, which

are identical to the call back tones, provide the operator with an indication that he has keyed up on a voice channel. Since this feature is a code-plug-implementable option, it can be provided on a select number of mobile units as desired.

3.4 AUTOMATIC RETRY

A channel request is initiated by depressing the PTT pushbutton and causing the transmitter to send a burst of data to the system central controller via the control channel. Since a single burst of data may not get through because of adverse signaling conditions or interference, the radio unit is designed to keep on sending channel requests until a request acknowledgment is received from the system central controller or until four seconds have elapsed. These attempts will continue even if the operator releases his PTT switch. Thus, the operator is not required to continually depress his PTT pushbutton in an attempt to gain access to the system.

3.5 RECENT USER PRIORITY

This feature provides users who have been assigned voice channels with priority over other system users, thus insuring that a fleet engaged in a message transmission will get system access priority even if there is a significant delay between transmissions. This reduces the possibility of a channel not becoming available during an exchange of transmissions if a mobile or control station operator is slow in responding.

3.6 OUT-OF-RANGE TONES

This tone is provided whenever the operator cannot access the system because the system is out of service or when the unit being called is out-of-range.

3.7 MISDIRECTED MOBILE PROTECTION

To insure that no mobile unit from one fleet will accidentally be assigned to a voice channel used by a different fleet, a subaudible data handshake is implemented in the system. Once a fleet is assigned to a voice channel, the repeater of the assigned channel will keep on sending an outbound stream of subaudible data containing the unique fleet or subfleet ID of the units using the channel. Should a unit from a different fleet or subfleet be accidentally assigned to the same channel, the unit would automatically revert to the control channel since it does not have the proper ID. The audio of the erring mobile unit would be muted and the transmitter disabled for the fraction of a second that it actually spent on the wrong channel and thus could neither monitor nor key up on the wrong channel.

3.8 CONTINUOUS ASSIGNMENT UPDATING

Once a voice channel is assigned to a fleet or subfleet, the control channel will keep on transmitting the channel assignment for as long as that fleet is using the channel. This insures that a mobile or control station just coming into service will be sent over to the appropriate channel to join the rest of his fleet. The assignment updating information will be sent serially, and the total time that will be required by the control channel to run through 19 assignments on a 20-channel system is approximately 500 milliseconds.

4. SYSTEM EXPANSION FEATURES

Motorola Advanced Trunked *Syntor X* Communications Systems are structured such that they allow the addition of mobile units without affecting the operation and privacy of control stations units currently using the system. Mobile units can be added to an existing user fleet or new users can be added without the need for any system changes within the capacity limitations of the system. To increase the number of channels in an Advanced Trunked *Syntor X* system, all that needs to be done is to add the necessary base station and central controller equipment. It is not necessary to modify any Advanced Trunked *Syntor X* mobile or control station to add additional channels. The Advanced Trunked *Syntor X* radio will automatically accommodate the added voice channels.

5. SIGNALING

5.1 Effective system operation has been achieved by binding the individual system blocks into a highly efficient coordinated entity by means of the data communications network. The majority of the data communications operations occurs over the system control channel. For example, requests for service are transferred from the system users to the central controller over this channel. Similarly, the control channel is used by the central controller to transfer channel assignment data or other control commands to the users.

5.2 All communications over the control channel employ data words which are approximately 23 milliseconds long. These data words contain the information capacity required to address mobile units or control stations and to specify the action to be taken. The information bits comprising these words are appropriately assembled into a coded format that has sufficient error-correction and detection capabilities to insure that highly reliable data communications will be maintained in a two-way mobile radio environment. The encoded binary data is passed to the transmitter at a 3600-baud rate where it is filtered and impressed on the carrier by using direct baseband frequency modulation.

6. CONVENTIONAL SYSTEM DESCRIPTION

6.1 INTRODUCTION

6.1.1 The Advanced Trunked *Syntor X* FM Two-Way Control Station is a compact two-way FM radio designed for desk or table top installations. Communications systems in the 800 MHz band usually employ a repeater station, located at a site that offers good propagation characteristics, to assure coverage of the area. The frequencies assigned to the control station are identical to those assigned to the mobile radios, and transposed with regard to the repeater station. Thus, all communications is routed through the repeater. Since the control station must transmit and receive to and from the repeater station only, a directional antenna is normally used. Transmitter rf power requirements are relatively low; the variable power capability of the control station transmitter permits compliance with FCC licensing.

NOTE

Control stations in the 800 MHz band are FCC licensed to operate at or below a specified effective radiated power (ERP). The ERP of the station is related to the rf power output of the transmitter, antenna transmission line loss and antenna gain. The maximum rf power output of the transmitter that will be permitted, must be determined by a communications specialist. This rf power figure may be equal to or below the maximum capability of the station. Record the ERP figure for reference for future servicing and alignment of the station.

- 6.1.2 The station can be controlled from either extended local desk sets or remote control units.
- 6.1.3 The radio is available with carrier squelch, Private-Line™ (PL) tone-coded squelch, or Digital Private-Line™ (DPL) binary-coded squelch. These are available in single or multiple-frequency models.
- 6.1.4 All control stations are designed for desk or table top installation and fully utilize the advantages of solid-state circuits reliability, small size, ruggedness and low maintenance requirements. Contained within the compact steel cabinet is an easily removable transmitter/receiver unit, and ac operated power supply. The rear of the cabinet is equipped with an antenna connector and terminal boards for external connections. Efficient heat radiators to ensure safe operating temperatures for the transmitter power amplifier stages and the power supply regulator transistors extend from the rear of the cabinet.
- 6.1.5 The station cabinet facilitates ease of maintenance and is easily removed from the chassis assembly by loosening two thumb-screws at the rear of the cabinet. All external connections are made at terminal boards at the rear of the chassis and need not be disturbed for removal of the cabinet. The transmitter/receiver chassis is secured to the main chassis assembly by two hex-head screws. When these are released, the transmitter/receiver unit may be readily removed for maintenance or quick access to the area below the transmitter/receiver unit.

6.2 BASIC TYPES OF SYSTEMS

6.2.1 Carrier Squelch

This type of system is used when all transmissions on a specific frequency are to be heard. The receivers incorporate a noise-actuated squelch circuit consisting of a noise limiter, a noise detector and a dc control stage (switching circuit) to cut off the first audio amplifier. This eliminates disturbing noise which would otherwise be heard at the speaker during intervals between received messages.

6.2.2 Private-Line Coded Squelch

6.2.2.1 Either one of two types of *Private-Line* coded squelch may be used; tone-coded or binary-coded. In *Private-Line* tone-coded squelch systems, subaudible tones (67-210 Hz) are transmitted and then detected to unsquelch the audio path in a particular receiver or group of receivers. In *Digital Private-Line* binary-coded squelch systems, a 23-bit binary code word is transmitted continuously and detected to unsquelch the audio path in the receiver(s). The binary code rate is such that it falls below the 300-3000 Hz voice frequency range used in radio communications equipment, therefore, the code signals are not heard by the operator.

The transmitters are modulated by a subaudible continuous code signal in addition to the voice modulation. The receivers accept only correctly code-modulated signals when the MONITOR switch on the desk set is not depressed.

6.2.2.2 *Private-Line* coded squelch models also include noise-actuated squelch circuitry as previously described for carrier squelch models. This enables the operator to monitor the channel before transmissions (MONITOR switch depressed) and prevent interference with other users of the frequency.

6.2.2.3 The SQUELCH control (internal) has no effect on "PL" squelch sensitivity. In normal operation ("PL" ON), the receiver audio is activated when the on-frequency rf signal is fm modulated with the proper "PL" code to activate the *Private-Line* decoder.

7. CONTROL FACILITIES

Advanced Trunked *SYNTOR X* Control Stations can be controlled by extended local desk sets, and/or telephone remote units. A total of six control points made up of any mix of local desk sets and remote units can be used.

7.1 EXTENDED LOCAL DESK SET

7.1.1 A single Model L1236A Extended Local Desk Set can control the Advanced Trunked *SYNTOR X* Control Station up to a distance of 1200 feet. When using multiple extended local desk sets, the total sum of the cable lengths can not exceed 1200 feet. The L1236A Extended Local Desk Set can be powered from the Advanced Trunked *SYNTOR X* Control Station if the cable distance between the two units is 400 feet or less.

7.1.2 The L1236A Extended Local Desk Set must be powered by a wall mount AC Power Supply (Model TDN7239A) if the cable distance between any extended local desk set and the control station is greater than 400 feet. The excessive DC voltage drop in the control cable length over 400 feet is the reason for the need of the wall mount external AC power supply.

7.1.3 The 1200 foot limit is due to the capacity between the conductors in the special data cable. Control cables must be installed indoors only. This equipment is not designed to tolerate transients that may occur on

outside installed cables. Care should be observed when installing control cables. Cables should be routed away from noisy power line cables, electrically noisy equipment, and any type of equipment that may generate strong magnetic fields.

7.2 TELEPHONE REMOTE UNIT

A telephone line remote desk set with a modem is available when the distance between the control station and the control point is greater than the extended local desk set can handle.

8. CONTROL STATION EQUIPMENT

8.1 CHASSIS AND PANEL

The chassis contains the transmitter/receiver unit, the power supply and intercom board. The power supply is secured to the chassis by means of four mounting screws. The transmitter/receiver unit is secured to the chassis by two 10-32 screws on the side of the chassis. The intercom board mounts on the chassis below the transmitter/receiver unit. Since this unit is not locally controlled, the panel contains no controls. The unit is turned on by plugging the ac cord into an ac outlet.

8.2 POWER SUPPLY (TPN1197A)

A 120-volt, 60 Hz power supply provides the equipment and the optional accessories with the required dc voltages. The power supply is secured to the main chassis by means of four screws which can be easily removed. An easily accessible connector located on the power supply is used for connecting the supply output to the control panel and the transmitter/receiver unit. The regulating transistors are mounted on an efficient heat radiator at the rear of the power supply to insure safe operation of the equipment. A fuse located on the power supply chassis provides ac line protection. Refer to the TRN1197A Power Supply attachment, 68P81064E13.

8.3 INTERCOM BOARD

An intercom board is mounted in the area below the transmitter/receiver unit to provide intercom capabilities between control points and monitoring of all control station audio traffic. The intercom board includes a disable gate which gives the receiver audio priority over intercom communication. A second gate on the intercom board eliminates audio from two sources appearing on the phone line during a PTT or intercom function from a telephone remote.

8.4 RADIO FEATURES

The Advanced Trunked *Syntor X* FM Two-Way Control Station, including options, provides the following features:

- microcomputer-controlled trunked system
- broad-band operation
- frequency synthesis
- improved transmitter and receiver performance
- time-out-timer
- multiple system select of up to 15 trunked systems and 10 conventional channels (the 10 conventional channels can be any mix of DPL, PL, and carrier squelch)
- up to 15 subfleet selections plus fleet call
- unlimited *Call Alert* page
- unlimited *Private Conversation* call
- emergency call and alarm option which provides channel access during emergency situations
- dynamic reprogramming (regrouping) option which allows a dispatcher/supervisor to temporarily reassign individuals operating in separate subfleets to "regroup" into one communications subfleet
- wide operating temperature range (-30°C to +60°C)
- all solid-state, compact modular design that simplifies radio maintenance and troubleshooting.

NOTE

Refer to instruction manual 100S-SP5290317 for a complete list of optional features.

8.4.1 Microcomputer-Controlled Trunked System

8.4.1.1 Most major radio set operations are controlled by an 8-bit micro-processor, a read only memory (EPROM) that contains the operating program, and associated support and control circuitry. This sophisticated micro-computer system is designed to simplify operation by elimination of manual frequency selection, squelch control, and monitoring requirements.

8.4.1.2 All unique user-specified operating parameters are contained in the code plug EEPROM on the personality board. This permits the radio to be easily customized to meet specific customer requirements. Operational modifications are implemented by simply replacing the code plug with the one that has been programmed according to the user's requirements. Consequently, a Advanced Trunked *Syntor X* radio can be easily be moved between fleets having different operating parameters.

8.4.2 Broad-Band Operation

The Advanced Trunked *Syntor X* radio can operate over the entire 800 MHz dispatch spectrum. Since frequencies can be added or changed without retuning or realigning the radio, the unit can operate in different systems on widely separated frequencies.

8.4.3 Frequency Synthesis

Specific radio frequencies are generated electronically by using a frequency synthesizer rather than individual crystals or channel elements. This simplifies multiple-frequency operation since frequencies can be changed or added by plugging in a different code plug on the personality board.

8.4.4 Improved Transmitter and Receiver Performance

The Advanced Trunked *Syntor X* transmitter provides audio distortion rated at less than 2% (at 1000 Hz, 60% maximum deviation) and a frequency stability of $\pm 0.0002\%$ of assigned center frequency (over an ambient temperature range from -30°C to $+60^{\circ}\text{C}$). Spurious and harmonic emissions are rated at greater than 85 dB below carrier. Sensitivity of the receiver is rated at 0.25 microvolts (EIA SINAD), and spurious and image rejection is -100 dB. Frequency stability is identical to that of the transmitter.

8.4.5 Time-Out-Timer

The Motorola time-out-timer is a "supervisory" device designed to turn off the control station transmitter after a programmed time length of continuous transmission. The code plug can be ordered to cause the time-out-timer to time-out at lengths of 0 (no time-out), 15, 30, or 60 seconds. In addition, it provides an alert tone to the receiver audio circuit to signal the local operator that the transmitter is no longer on-the-air. The time-out-timer is reset when the push-to-talk switch is released, permitting transmission to be resumed for another timer length.

8.4.6 Multiple System Select

8.4.6.1 The multiple system select options permit the access of several trunked systems, and conventional systems within the operating range of the control station. The control station, however, must be licensed for these systems and permission must be obtained from the system's owners before use of the systems is attempted.

8.4.6.2 In the trunked mode, the multiple system select feature permits the operator to access one of up to 15 different trunked systems or fleets in a local area or in various geographic regions. Each trunked system can provide up to 20 trunked channels. In the conventional mode, up to 10 conventional channels are selectable.

8.4.7 Subfleet Select

This feature allows an operator to select one of up to 15 subfleets or the entire fleet. When used in conjunction with multiple system select, these fleet/subfleet combinations can be accessed in any one of up to 15 trunked systems.

8.4.8 Unlimited Call Alert Page Option

This feature permits the operator to alert a unit to a call. The *Call Alert* page option sends alert tone data to a unit specified by a six-digit ID code. The receiving unit uses the alert tone data to generate a repeating alert tone (four tone bursts) and causes the call light indicator on the receiving unit to flash. In this way, a unit can be alerted to a call from the system controller. The *Call Alert* page function is handshake operation, whereas the system controller sends the alert tone data to a unit and the call light indicator on the control station (green light) turns on. The receiving unit being called sends remote unit acknowledgment tones back to the control station, and flags the operator of the control station by turning off the call indicator light.

8.4.9 Unlimited Private Conversation II™ Call

This feature allows the operator to place and receive private calls from another unit. The system controller sends out private *Call Alert* page tone data to the receiving unit specified by the six-digit ID code. When the mobile unit receives the private tone data, the call light on the receiving unit will flash and an alert tone will be heard twice. When the operator of the receiving unit responds to the call, the call light of the receiving unit remains steadily on. (The steady "ON" indication of the call light flags the receiving operator that the call is a private call.)

8.4.10 Trunking Scan Option

This feature allows the control station operator to scan subfleet channels. At time of order, a scan list is determined by the customer for some or all of the trunking systems.

8.4.11 Individual Call Alert Page Decode Option

This feature allows the operator to receive a *Call Alert* page from a mobile.

8.4.12 Unlimited individual Call Alert Page Encode/Decode Option

This feature allows the dispatcher/supervisor to selectively alert any individual in the system.

8.4.13 Horn and Lights

When the control station receives a *Call Alert* page (optional) or a *Private Conversation* call (optional), a transistor relay driver is turned on. If an external alarm is desired, an optional relay can be connected to the alarm connections on AUX+ and AUX- (on the desk set) to turn on external alarms.

8.4.14 Emergency Call and Alarm

This feature allows the operator to have voice and/or control channel access during emergency situations.

8.4.15 Dynamic Reprogramming Option

This feature allows the dispatcher or shift supervisor to temporarily reassign individuals operating in separate subfleets to reprogram or "regroup" into one communications subfleet.

8.4.16 Antenna

An antenna is not provided with the Advanced Trunked *Syntor X* FM Two-Way Radio Control Station. Local operating conditions dictate the type of antenna that should be used. Contact your local Motorola Service Representative or Motorola Service Station (MSS) for your antenna selection and ordering needs.



9. INSTALLATION

9.1 INSPECTION AND UNPACKING

Inspect the equipment very carefully and report any damage to the transportation company as soon as possible.

CAUTION

Perform the following unpacking procedures before powering up the control station.

- 9.1.1 Before using the trunked control station, it must be opened to remove packing material inserted inside the control station cover.
- 9.1.2 After making sure that the control station is not plugged into the ac power source, unscrew the two cover thumb screws located on the back cover of the control station. They are captivated to the cover and cannot be removed completely.
- 9.1.3 Slide the control station cover to the rear until it clears the chassis and can be lifted away.
- 9.1.4 Remove and discard the cardboard insert located along the inside edge of the control station cover. Also, remove and discard the sheet of white foam taped to the top of the Advanced Trunked Syntor X radio. Slide the cover back on the chassis from the rear and tighten the two thumb screws to securely fasten the cover to the control station chassis.

9.2 ANTENNA AND TRANSMISSION LINE

- 9.2.1 The antenna and transmission line are not included with the control station since each installation has its own transmission requirements. Consult your nearest Motorola Service Representative for advice.
- 9.2.2 The antenna should preferably be installed before installation of the control station equipment. Consult the instructions included with the antenna and transmission line kits.

9.3 LOCATION OF EQUIPMENT

- 9.3.1 Studies to determine the best location for the equipment should be made before any installation work is undertaken. The studies should take the following into consideration:
 - convenience of the ac power source
 - accessibility of the transmission line
 - accessibility of the control cables

9.3.2 The control station equipment should be placed over a solid, level surface (such as a desk or table). Also, the transmission line should be kept as short as possible to minimize losses.

9.4 ANTENNA CONNECTION

Connect the antenna transmission line terminal to the antenna jack J501 provided on the back of the control station as shown in Figure 1.

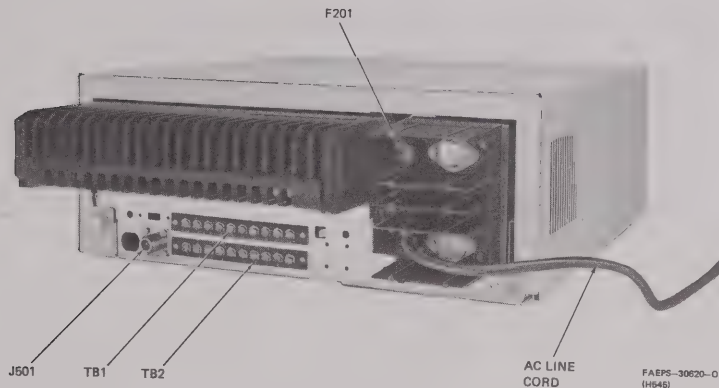


Figure 1. Location of Connectors

9.5 AC POWER CONNECTION

The control station is supplied with a standard power supply designed to operate from a 120-Volt, 50/60 Hz ac power source. The control station can also operate from optional 100, 220, 240 V ac or 12 V dc power sources. The power supply is provided with a three-wire cord terminated with a three-prong plug.

9.6 CONTROL CONNECTIONS

The control station can be controlled from a maximum of six control points. These control points can be any mix of extended local desk sets and telephone remote desk sets.

9.6.1 Extended Local Control Cables

The cables described provide the interconnection between *SYNTOR X* Advanced Trunked Control Stations, Extended Local Desk sets, and the Extended Local

Junction Box. Two individual jacketed cables comprise one cable set required to make a complete interconnection; the data cable and the audio/control cable. The cables are cut to length, stripped, and lugged with spade lugs at both ends.

9.6.1.1 Data Cable

The data cable is Belden Type #9925 (or equivalent), which is a 3-conductor, #24 gauge wire plus shield, low capacitance (12 pF/ft) data cable. The cable is not finished identically at both ends. One end has the shield tied back and insulated to prevent connection at the Extended Local Desk set. The third wire (White) is not used and is cut at the strip of the outer jacket.

9.6.1.2 Audio And Control Cable

The audio and control cable is Motorola Part No. 30-83560A02 (or equivalent). The cable is finished identically at both ends. The white wire is not used and is cut at the strip of the outer jacket.

9.6.1.3 Lengths

Finished cable sets (TDN7240A) are available in the following lengths:

25 feet
50 feet
100 feet
200 feet
300 feet
400 feet
600 feet
1200 feet

Field requirements for application lengths other than above must be field installed by cutting or splicing above lengths.

When using multiple extended local desk sets, the total sum of the cable lengths CAN NOT EXCEED 1200 FEET. The cable length to a remote adapter (if installed) must also be included in the maximum total sum of 1200 feet.

9.6.2 Extended Local Desk Sets

9.6.2.1 Table 1 provides the information required to connect one or two extended local desk sets to the control station. If two extended local desk sets are installed, their leads are wired in parallel at the control station terminal strips (see Figure 1 and following diagram 4-SP5290317).

9.6.2.2 Table 2 provides the information required to connect three to six extended local desk sets to the control station (see Figure 1 and following diagram 6-SP5290317).

9.6.2.3 Table 3 provides the information required to connect extended local desk sets with series strung TDN7237A Junction Boxes (see Figure 1 and following diagram 7-SP5290317).

TABLE 1
ONE OR TWO EXTENDED LOCAL DESK SETS CONNECTED TO CONTROL STATION

DESK SET TERMINAL	CABLE COLOR	CABLE TYPE	STATION TERMINAL NO.	FUNCTION
DATA +	RED	Special Data	TB1-5	Serial Data +
DATA -	BLK	Special Data	TB1-4	Serial Data -
None	Shield	Special Data	TB2-4	Shield
DC+	RED	Multi-Conductor	*TB2-1	Supply Voltage (+13.6)
DC-	BLK	Multi-Conductor	TB2-2	Ground
RX+	YEL	Multi-Conductor	TB2-3	Speaker HI
RX-	GRN	Multi-Conductor	TB1-7 or 8	Speaker LO
TX+	BRN	Multi-Conductor	TB2-7	Mic HI
TX-	Shield	Multi-Conductor	TB2-6	Mic LO

** AC

** AC

* When cable length is greater than 400 feet, a TDN7239A ac power supply is required. Under these circumstances, the RED lead from the multi-conductor cable is not connected to TB2-1, but is insulated and tied back.

** Cable from TDN7239A ac power supply is connected to these screw terminals when required.

TABLE 2

THREE TO SIX EXTENDED LOCAL DESK SETS CONNECTIONS TO CONTROL STATION WITH JUNCTION BOX

A. CABLES FROM DESK SETS TO JUNCTION BOX

FROM		TO TDN7237A								
DESK SET	CABLES		JUNCTION BOX TERMINAL NUMBER							
TERMINAL	COLOR	TYPE	DESK SET 1	DESK SET 2	DESK SET 3	DESK SET 4	DESK SET 5	DESK SET 6	FUNCTION	REMARKS
DATA+	RED	S/D	1	2	3	4	5	6	SERIAL DATA+	
DATA-	BLK	S/D	11	12	13	14	15	16	SERIAL DATA-	
NONE	SHIELD	S/D	21	22	23	24	25	26	SHIELD	
DC+	RED	M/C	41	42	43	44	45	46	+13.6 V	See notes on Table 1.
DC-	BLK	M/C	31	32	33	34	35	36	GROUND	
RX+	YEL	M/C	61	62	63	64	65	66	SPEAKER HI	
RX-	GRN	M/C	71	72	73	74	75	76	SPEAKER LO	
TX+	BRN	M/C	81	82	83	84	85	86	MIC HI	
TX-	SHIELD	M/C	91	92	93	94	95	96	MIC LO	

**AC

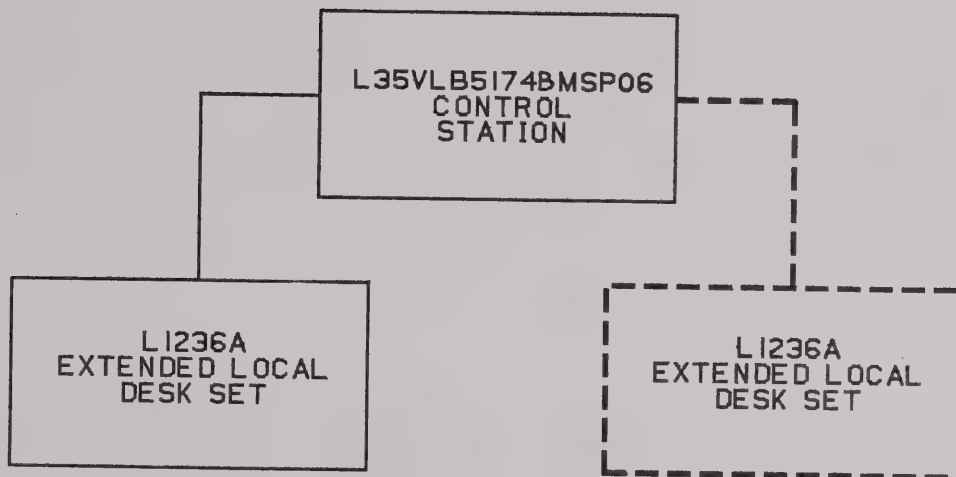
**See notes on Table 1.

B. CABLES FROM JUNCTION BOX TO CONTROL STATION

FROM		CABLE		TO		
TERMINAL	NUMBER	COLOR	TYPE	CONTROL STATION	FUNCTION	REMARKS
0		RED	S/D	TB1-5	SERIAL DATA+	
10		BLK	S/D	TB1-4	SERIAL DATA-	
20		SHIELD	S/D	TB2-4	SHIELD	
40		RED	M/C	TB2-1	+13.6 V	
30		BLK	M/C	TB2-2	GROUND	
50		WHT	M/C	TB1-10	TELEPHONE REMOTE	Not used on extended local system.
60		YEL	M/C	TB2-3	SPKR HI	
70		GRN	M/C	TB1-7	SPKR LO	
80		BRN	M/C	TB2-7	MIC HI	
90		SHIELD	M/C	TB2-6	MIC LO	

S/D = SPECIAL DATA

M/C = MULTI-CONDUCTOR



NOTES:

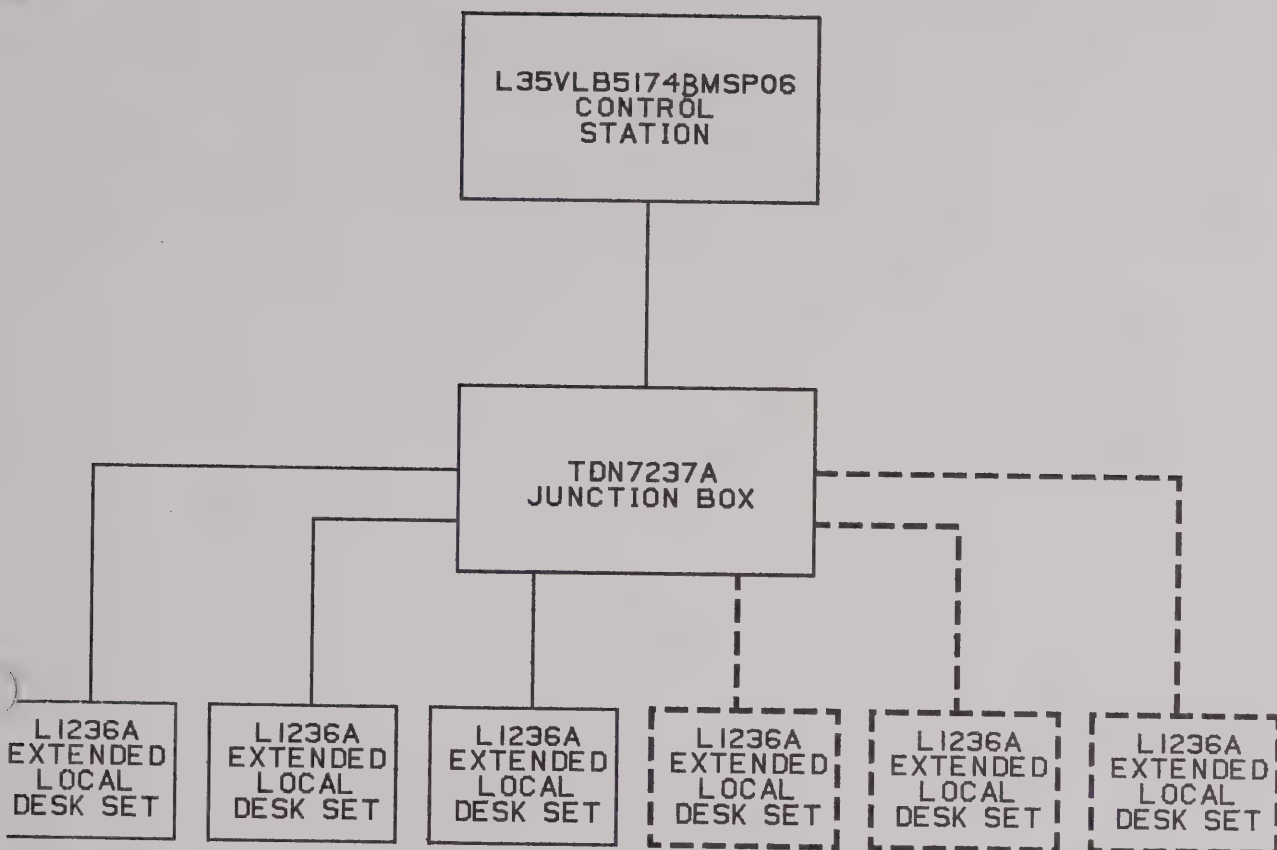
1. TOTAL LENGTH OF ALL CONTROL CABLES CAN NOT EXCEED 1200 FEET.
2. AN AC WALL MOUNT POWER SUPPLY (TDN7239A) MUST BE USED ON THE L1236A EXTENDED LOCAL DESK SET IF CONTROL CABLE LENGTH IS GREATER THAN 400 FEET.
3. CONTROL CABLE MUST BE INSTALLED INDOORS ONLY.
4. UP TO A COMBINED TOTAL OF SIX CONTROL POINTS MAY BE USED.

4-SP5290317-2

One To Two Extended Local Desk Set
System Configuration

Motorola No. 4-SP5290317-2

5/19/88



NOTES:

1. TOTAL LENGTH OF ALL CONTROL CABLES CAN NOT EXCEED 1200 FEET
2. AN AC WALL MOUNT POWER SUPPLY (TDN7239A) MUST BE USED ON THE LI236A EXTENDED LOCAL DESK SET IF CONTROL CABLE LENGTH IS GREATER THAN 400 FEET.
3. CONTROL CABLE MUST BE INSTALLED INDOORS ONLY.
4. UP TO A COMBINED TOTAL OF SIX CONTROL POINTS MAY BE USED.

6-SP5290317-2

Three To Six Extended Local Desk Set
System Configuration

Motorola No. 6-SP5290317-2

5/19/88

TABLE 3

TYPICAL EXTENDED LOCAL DESK SET WITH TDN7237A JUNCTION BOX SERIES STRUNG SYSTEM CONFIGURATION

A. CONNECTIONS FROM CONTROL STATION TO JUNCTION BOX 1, EXTENDED LOCAL DESK SET 1, AND JUNCTION BOX 2

CONTROL STATION TERMINAL NO.	CABLE		JUNCTION BOX-1	CABLE		EXTENDED LOCAL DESK SET-1		JUNCTION BOX-2	FUNCTION	REMARKS
	COLOR	TYPE		COLOR	TYPE					
TB1-5	RED	S/D	1							
TB1-4	BLK	S/D	11						SPECIAL DATA+	
TB2-4	SHIELD	S/D	21						SPECIAL DATA-	
*	RED	M/C	41						SHIELD	
										*Not required, cut lead at control station and tape back.
TB2-2	BLK	M/C	31							
*	WHT	M/C	51						GROUND	
										*Not required, cut lead at control station and tape back.
TB2-3	YEL	M/C	61							
TB1-7	GRN	M/C	71						SPEAKER HI	
TB2-7	BRN	M/C	81						SPEAKER LO	
TB2-6	SHIELD	M/C	91						MIC HI	
			0	RED	S/D	DATA+			MIC LO	
			10	BLK	S/D	DATA-			SERIAL DATA+	
			20	SHIELD	S/D	NONE			SERIAL DATA-	
			*	RED	M/C	DC+			SHIELD	
										*Not required, cut lead at junction box and tape back.
			30	BLK	M/C	DC-				
			60	YEL	M/C	RX+			GROUND	
			70	GRN	M/C	RX-			SPKR HI	
			80	BRN	M/C	RX+			SPKR LO	
			90	SHIELD	M/C	TX-			MIC HI	
						AC			MIC LO	
						AC			AC POWER INPUT	
			2	RED	S/D				AC POWER INPUT	AC Cable from TDN7239A P.S.
			12	BLK	S/D			1	SERIAL DATA+	
			22	SHIELD	S/D			11	SERIAL DATA-	
			42	RED	M/C			21	SHIELD	
			32	BLK	M/C			41		
			62	YEL	M/C			31	GROUND	
			72	GRN	M/C			61	SPKR HI	
			82	BRN	M/C			71	SPKR LO	
			92	SHIELD	M/C			81	MIC HI	
								91	MIC LO	

S/D = SPECIAL DATA
M/C = MULTI-CONDUCTOR

TABLE 3

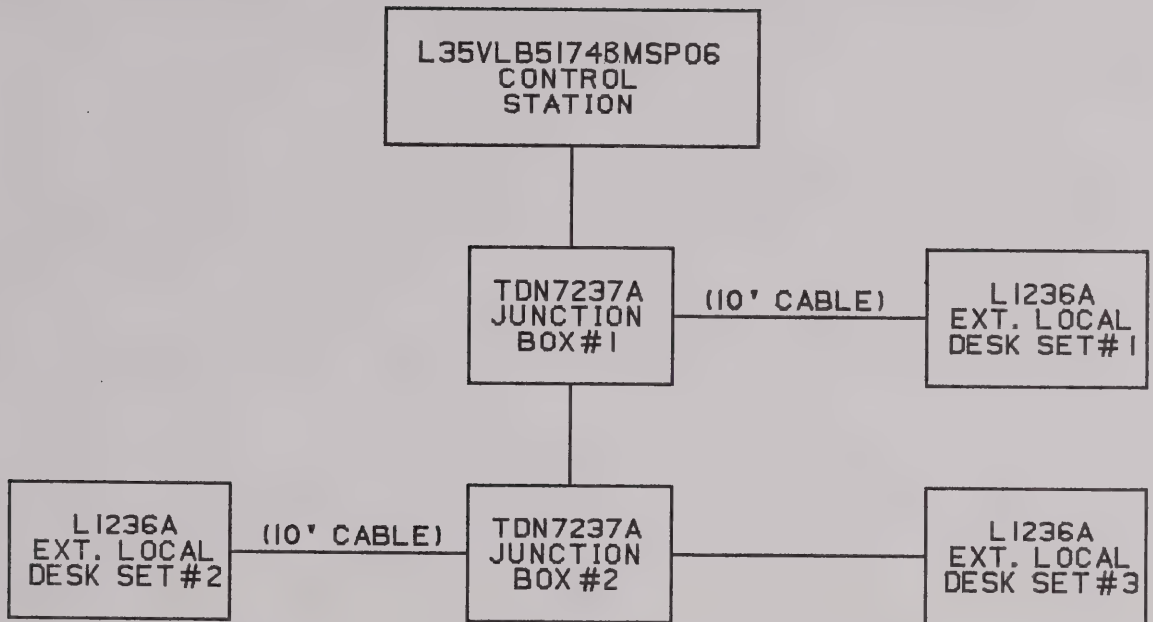
TYPICAL EXTENDED LOCAL DESK SET WITH TDN7237A
JUNCTION BOX SERIES STRUNG SYSTEM CONFIGURATION
(cont'd)

B. CABLES FROM JUNCTION BOX 2 TO EXTENDED LOCAL DESK SETS 2 AND 3

JUNCTION BOX-2	CABLE		EXTENDED LOCAL DESK	EXTENDED LOCAL DESK	FUNCTION	REMARKS
	COLOR	TYPE	SET-2	SET-3		
0	RED	S/D	DATA+		SERIAL DATA+	
10	BLK	S/D	DATA-		SERIAL DATA-	
20	SHIELD	S/D	NONE		SHIELD	
*	RED	M/C	DC+			*Not required, cut lead at junction box and tape back.
30	BLK	M/C	DC-		GROUND	
60	YEL	M/C	RX+		SPKR HI	
70	GRN	M/C	RX-		SPKR LO	
80	BRN	M/C	TX+		MIC HI	
90	SHIELD	M/C	TX-		MIC LO	
			AC		AC POWER INPUT	
			AC		AC POWER INPUT	AC Cable from TDN7239A P.S.
2	RED	S/D		DATA+	SERIAL DATA+	
12	BLK	S/D		DATA-	SERIAL DATA-	
22	SHIELD	S/D		NONE	SHIELD	
*	RED	M/C		DC+		*Not required, cut lead at junction box and tape back.
32	BLK	M/C		DC-	GROUND	
62	YEL	M/C		RX+	SPKR HI	
72	GRN	M/C		RX-	SPKR LO	
82	BRN	M/C		TX+	MIC HI	
92	SHIELD	M/C		TX-	MIC LO	
				AC	AC POWER INPUT	AC Cable from TDN7239A
				AC	AC POWER INPUT	AC Cable from TDN7239A

S/D = SPECIAL DATA

M/C = MULTI-CONDUCTOR



NOTES:

1. TOTAL LENGTH OF ALL CONTROL CABLES CAN NOT EXCEED 1200 FEET.
2. TDN7239A AC WALL MOUNT POWER SUPPLIES ARE REQUIRED ON ALL L1236A EXTENDED LOCAL DESK SETS.
3. 10 FOOT CABLES SHOWN ARE SUPPLIED WITH JUNCTION BOX. LONGER CABLES CAN BE USED IF REQUIRED.
4. CONTROL CABLES MUST BE INSTALLED INDOORS ONLY.
5. UP TO A COMBINED TOTAL OF SIX CONTROL POINTS MAY BE USED.

7-SP5290317-2

9.6.3 Extended Local and Telephone Remote Mixed System

Diagram 8-SP5290317 illustrates a typical extended local and telephone remote mixed system.

9.6.4 Telephone Remote Only System

Diagram 9-SP5290317 illustrates a telephone remote only system. Standard voice grade telephone lines or microwave links can be used to operate the control station through the L1238A remote adapter.

9.7 CODE PLUG

9.7.1 Each control station in the Advanced Trunked *Syntor X* Communications System is provided with a code plug (HLN1186A) that is programmed to contain information required for operation of the station. The code plug, an electrically erasable PROM integrated circuit, plugs into a 25-pin socket located on the trunking personality board.

9.7.2 The code plug is programmed at the factory in accordance with the information supplied by the user and is not re-programmable by the user. Contact either a Motorola representative or an MSS if it becomes necessary to replace or modify the code plug.

9.7.3 Some code plug selectable options are as follows:

- Time-out-timer lengths of 0 (no time-out), 15, 30, or 60 seconds.
- Talk permit option; the talk permit tone will sound briefly whenever the operator is given a channel.
- Failsafe assignment; this option designates which channel, if any, the unit will be assigned to should the system central controller fail.
- Subfleet select; this option designates which subfleets (1 through 15) will be used. (Units with no subfleet select capability must designate which subfleet, if any, will be used.)
- Multi-Personality 8 or 16; permits a mix of one trunked system and up to 7 or 15 additional trunked and conventional systems.
- Multi-Personality 25; permits selection of up to 10 conventional systems and up to 15 trunked systems.
- *Private Conversation* call options; allow the operator to make or receive private calls.
- *Call Alert* page encode/decode; allows control station to selectively alert or be alerted by individual mobile units.

NOTES: A/62A

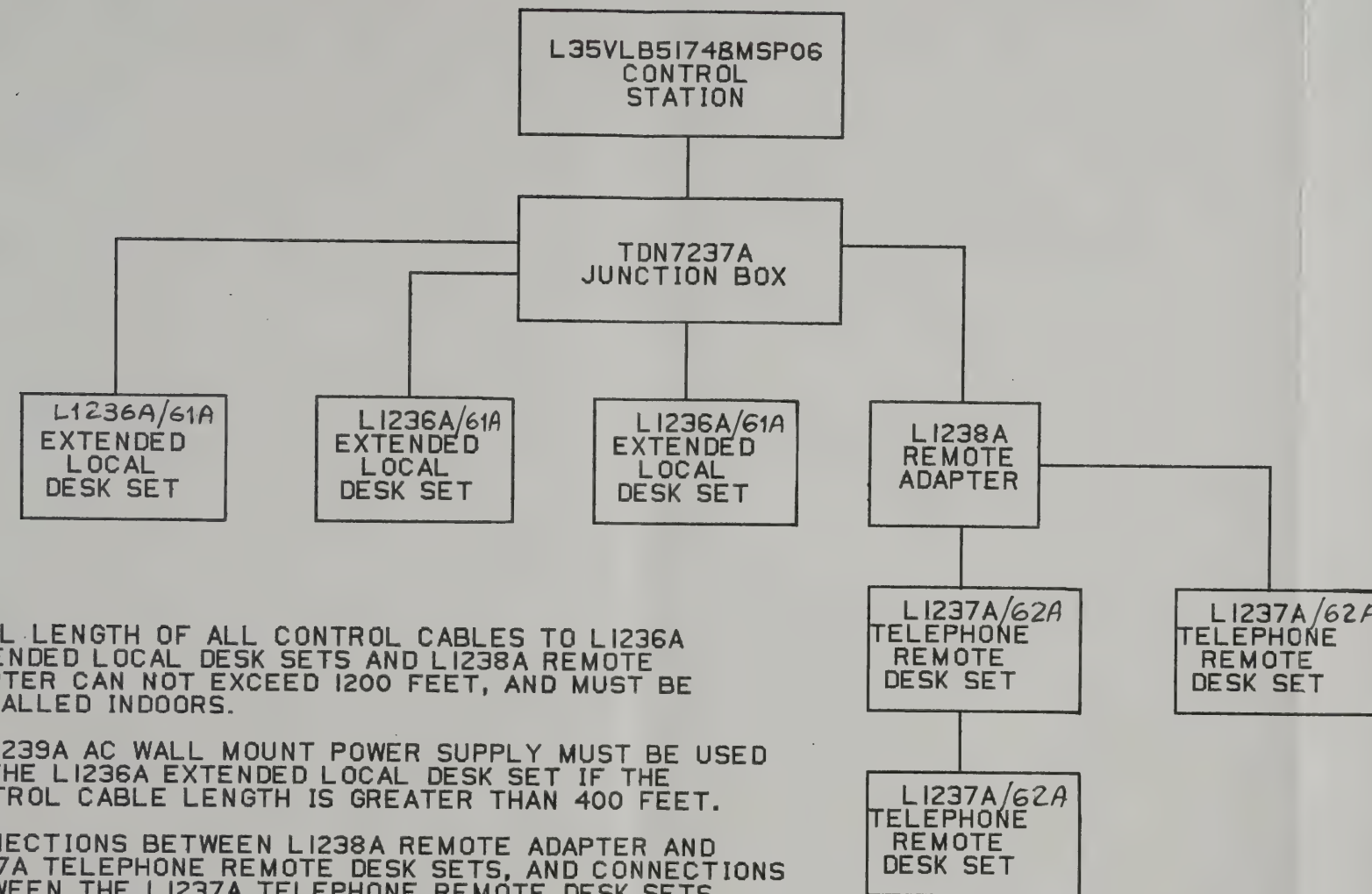
1. TOTNE
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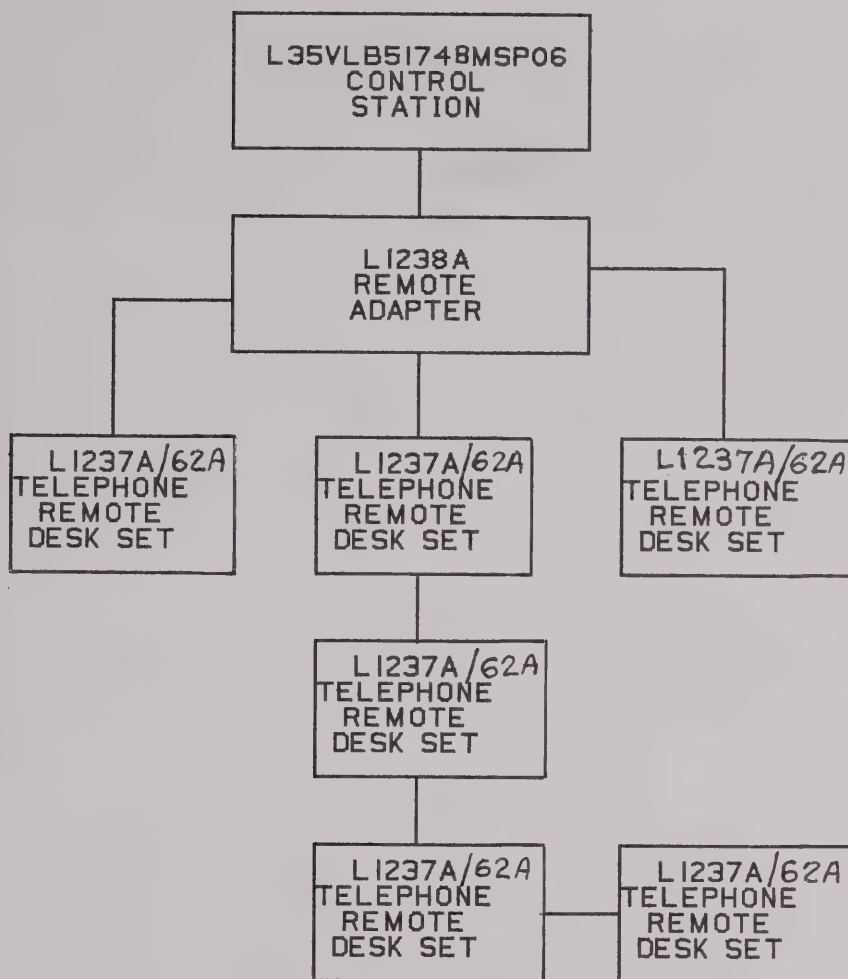
5. L12
L12
DES



NOTES:

1. TOTAL LENGTH OF ALL CONTROL CABLES TO L1236A EXTENDED LOCAL DESK SETS AND L1238A REMOTE ADAPTER CAN NOT EXCEED 1200 FEET, AND MUST BE INSTALLED INDOORS.
2. TDN7239A AC WALL MOUNT POWER SUPPLY MUST BE USED ON THE L1236A EXTENDED LOCAL DESK SET IF THE CONTROL CABLE LENGTH IS GREATER THAN 400 FEET.
3. CONNECTIONS BETWEEN L1238A REMOTE ADAPTER AND L1237A TELEPHONE REMOTE DESK SETS, AND CONNECTIONS BETWEEN THE L1237A TELEPHONE REMOTE DESK SETS CAN BE ON PREMISE CABLE, LEASED TELEPHONE LINE, OR MICROWAVE LINK.
4. UP TO A COMBINED TOTAL OF SIX CONTROL POINTS MAY BE USED.
5. *L1236A/37A USED FOR SMARTNET MODELS AND L1261A/62A USED FOR PRIVACY PLUS MODELS. DESK SET MODELS CANNOT BE INTERMIXED.*

8-SP5290317-2



NOTES:

1. THE CABLE LENGTH BETWEEN THE CONTROL STATION AND THE L1238A REMOTE ADAPTER CAN NOT EXCEED 1200 FEET AND MUST BE INSTALLED INDOORS.
2. CONNECTIONS BETWEEN L1238A REMOTE ADAPTER AND L1237A TELEPHONE REMOTE DESK SETS CAN BE ON PREMISE CABLE, LEASED TELEPHONE LINE, OR MICROWAVE LINK.
3. UP TO A COMBINED TOTAL OF SIX CONTROL POINTS MAY BE USED.
4. L1237A USED FOR SMARTNET MODELS AND L1262A USED FOR PRIVACY PLUS MODELS.
DESKSET MODELS CANNOT BE INTERMIXED.

9-SP5290317-2

Typical Telephone Line Remote
System Configuration
Motorola No. 9-SP5290317-2
5/19/88

9.8 TRANSMITTER/RECEIVER ADJUSTMENT

The control station transmitter and receiver are accurately adjusted and aligned at the factory before shipment. The equipment should be checked before it is put into actual use to ascertain that the equipment adjustment and alignment have not been disturbed during transit. Moreover, FCC regulations require that the transmitter output frequency, power, and deviation be checked before the equipment is placed into service. Refer to attached General Maintenance/Troubleshooting instruction section 68P81067E03 (in this manual) for information on these procedures.

9.9 POWER SUPPLY ADJUSTMENT

The power supply does not require any adjustment since all adjustments are made at the factory. It is advisable to check and verify that the power supply provides an output of 13.6 V dc. Adjust R8 mounted on the TPN6147A regulator board of the TPN1197A power supply if the power supply requires adjustment.

9.10 WALL OR RACK MOUNT KIT (TLN4427A)

9.10.1 Description

This kit is used where wall or rack mounting of a control station is desired. The control station radio may be mounted in any 19-inch rack having a depth of 6-1/2 inches, or it may be attached to a wall panel. When mounted, the control station is vertically oriented and operated in the extended local or remote control mode.

CAUTION

If the mounting bracket is secured to a panel using wood screws or blind studs, be sure it is solidly anchored into beams or an equivalent strong support to assure a safe mounting. If the bracket is not mounted to a strong support, a back-up plate and tie bolts (not included) should be used.

9.10.2 TLN4427A Kit Complement

QTY.	MOTOROLA PART NO.	DESCRIPTION
1	7-83733G01	Wall Mount Bracket
2	7-83709G01	Expander Bracket
6	3-135499	14-14 x 5/8" Screw
6	2-82360B07	14 U-Type Fastener
6	3-135468	1/4-20 x 1" Cap screw
6	2-2878	1/4-20 Nut
6	4-1792	Flat Washer
6	4-119331	Lock Washer, Split
11	3-6963	Screw, 10-32 x 3/8"
11	2-115123	Locknut, 10-32
6	3-83842C01	Screw, Lag, 1/4" x 2"

9.10.3 Installation

9.10.3.1 Wall Mounting
(Refer to Figures 2 and 3)

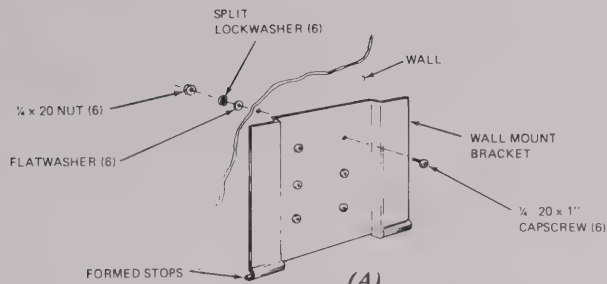
Step 1. Select a location for mounting the control station.

Step 2. Using the wall mounting bracket (7-83733G01) as a template, locate and drill six 9/32" holes through the wall.

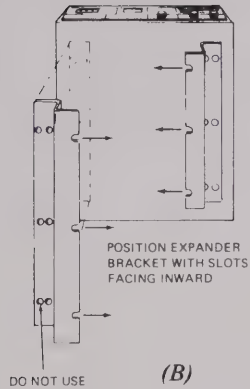
Step 3. Using six 1/4-20 x 1" cap screws, lock washers and nuts supplied, fasten the mounting bracket to the wall with the formed stops at the bottom.

NOTE

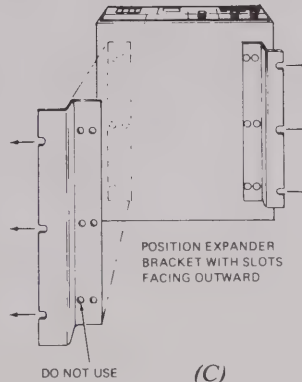
Six 1/4" x 2" lag screws are supplied for mounting the bracket to a masonry surface.



(A)
*Installation Detail
Wall Mount Bracket*



(B)
Wall Mounting



(C)
Rack Mounting

•GBEPS 31019 0

Figure 2. Installation Detail

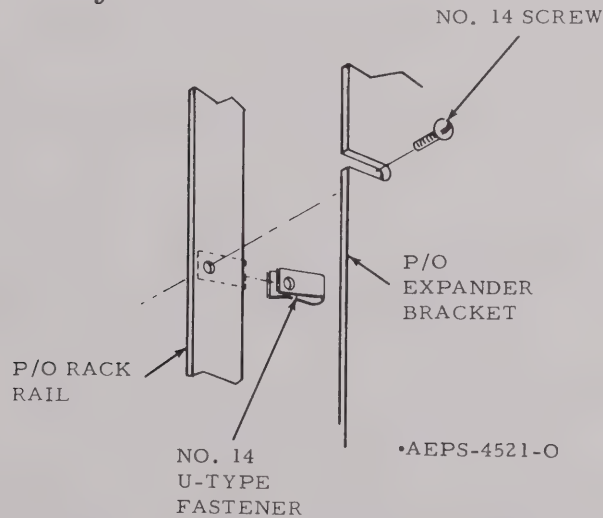


Figure 3. U-Type Fastener Detail

Step 4. Remove the housing, transmitter/receiver unit, and power supply from the control station.

Step 5. Using 11 10-32 screws and locknuts supplied, fasten the pair of expander brackets to the control station bottom plate with the "slots" facing inwards as shown in Figure 2 (B).

NOTE

When assembling expander brackets to bottom plate, insert screw through bottom plate first, so that head of screw is toward underside of radio chassis.

Step 6. Replace the control station transmitter/receiver unit, power supply, and housing.

Step 7. Carefully slide the complete assembly (control station and expander brackets) into its wall mount making certain that the expander brackets engage the mating rails on the wall bracket.

9.10.3.2 Rack Mounting

Step 1. Remove the housing, transmitter/receiver unit, and power supply from the control station.

Step 2. Using the 11 10-32 screws and locknuts, fasten the pair of expander brackets to the control station bottom plate. Position the expander brackets with the "slots" facing outwards as shown in Figure 2 (C).

Step 3. Replace the control station transmitter/receiver unit, power supply, and housing.

Step 4. Install the six No. 14 U-type fasteners supplied in the kit to the rack panel as shown in Figure 3.

Step 5. Mount the control station assembly into the rack and fasten with six No. 14 x 5/8" screws.

9.11 TRANSMITTER OUTPUT POWER ADJUSTMENT

The transmitter output is variable from 3 W to 10 W. It is recommended that the output power be set to the lowest output power that provides effective operation while minimizing interference to co-channel users.



MOTOROLA INC.

Communications
Group

LIGHTNING PROTECTION RECOMMENDATIONS

The conditions that make a site desirable for two-way radio are the same as those that make a site an excellent target for lightning. Proper lightning protection can completely prevent equipment damage in all but the most severe strikes and even then keep the equipment damage at a minimum. Lightning protection basically consists of preventing the strike from entering the equipment room and then preventing damage to the equipment from induced voltages and currents on power and control lines to the equipment. The following suggestions will help protect valuable radio facilities.

- Keep the tower grounding resistance as low as possible. The lightning stroke current belongs in the tower structure and grounding system, not on the transmission line.
- Use at least eight-foot long copper clad ground rods. Multiple ground rods are better than one especially in dry climate or sandy-rocky soil areas.
- Bring the transmission line off the tower with the sharpest bend permitted by the manufacturer's specifications and make a solid bond between the

tower and transmission line sheath just prior to the bend. The sharp bend acts as a spot impedance to the extremely high strike current. This shunts more of the strike current into the tower ground rather than into the equipment. Use no more or no less than the minimum bend radius wherever the transmission line changes direction and introduce a change of direction at every reasonable opportunity. Then, ground the transmission line sheath at the antenna side of each bend in the transmission line.

- Provide additional grounding to the transmission line sheath wherever possible. Make it a point to ground the transmission line where it is supported on poles and where it enters a building.
- It is wise to take at least part of the transmission line through a length of grounded conduit.
- **Bond all equipment cabinets together to a single point.** Then, ground that point to a grounding rod network using as short and as straight a ground wire as possible. If bends in the ground wire are necessary, make them as large a radius as practical.



Unprotected power/control lines and antenna installations can be hazardous to equipment and personnel.

- Transmission lines should be brought into the equipment cabinets adjacent to the single point ground connection where a good low impedance bond can be made with the transmission line sheath.
- Install a gas tube protector between the equipment cabinet ground and AC-neutral where it enters the equipment cabinet. Install gas tube protectors where the control lines enter the building and at the point of entry into the equipment cabinet. Also, install gas tube protectors wherever control lines enter a building and install additional protectors as close to the remote control console as possible.
- Keep ground wires from gas tube protectors to ground rods or perimeter grounds as straight and short as possible. Avoid sharp bends in ground wires.
- Never bundle a ground wire with any other cabling or wiring. Also, never run a ground wire along any metal wall, along any electrical conduit, or inside a conduit.

Remember, the lower impedance the grounding system is in relation to the equipment being protected, the greater the protection afforded to the equipment. Keep the lightning strike current in the grounding network; not running through the equipment to ground.

RECOMMENDED PROTECTORS

The devices listed below are available from your local Motorola Parts Center. Other devices are available from different manufacturers for special applications and may be used in place of those listed herein. Installation instructions are generally packed with each device. The following listing contains phone line suppressors, ac line surge protectors, coaxial cable in-line lightning arrestors, and coaxial cable ground clamp kits. Refer to the Motorola Buyers Guide for additional information.

PHONE LINE SUPPRESSORS

TRN8187A Single Line Suppressor, 3-electrode gas tube protector

TRN4589A Dual Line Suppressor, 3-electrode gas tube protector

RRX4021B Single Line Suppressor, 3-electrode gas tube protector

AC LINE SURGE PROTECTORS

TLN4399A AC Line Surge Protector, 117 V ac line, 7/8" x 14 conduit hole mounting

TLN5920A AC Line Surge Protector, 240 V ac line, 7/8" x 14 conduit hole mounting

RRX4017A AC Line Surge Protector, 117 V ac, 10 Amp, single phase, screw terminal connector block

RRX4018A AC Line Surge Protector, 117 V ac, 10 Amp, single phase, 3-prong plug and receptacle

RRX4019A AC Line Surge Protector, 117 V ac, 15 Amp, single phase, 3-prong plug and receptacle

RRX4020A AC Line Surge Protector, 220/240 V ac, 30 Amp, single phase

COAXIAL CABLE IN-LINE LIGHTNING ARRESTORS

ST-786 UHF type connector

ST-787 "N" type connector

COAXIAL CABLE GROUND CLAMP KITS

ST-788 For 1/2" jacketed heliax and pipe or grounding rod

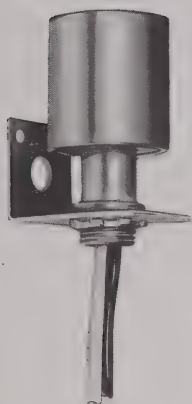
ST-853 For 7/8" jacketed heliax and pipe or grounding rod

ST-789 For 1/2" unjacketed heliax, includes bushings for better contact without collapsing line

ST-790 For 7/8" unjacketed heliax, includes bushings for better contact without collapsing line

AC LINE PROTECTOR

MODELS TLN4399A (120 V) AND TLN5920A (240 V)



AEPS-3774-O

1. INTRODUCTION

The ac line protector provides protection from power line transients, surges, and direct or indirect lightning strikes. It is a hermetically sealed, pre-ionized spark gap for use on all 120 V and 240 V ac equipment. The unit may be installed directly on the fuse box or it may be mounted on a wall, etc., by using an angle bracket. The line protector may be used in both indoor and outdoor applications.

2. INSTALLATION

a. Fuse Box Mounting

(1) Externally

Insert the wire leads and threaded neck through a 7/8-inch knockout in the fuse box. Thread the locknut onto the neck from inside the fuse box; tighten securely.

(2) Internally

For use on flush-mounted fuse boxes and in other situations where mounting the line protector outside the fuse box is impractical, it can be installed inside the fuse box. Install the unit on the angle bracket supplied. Bolt the angle bracket to the side or back of the fuse box. An alternate method is to bolt the unit to the fuse box with a piece of perforated metal strapping.

b. Bracket Mounting

This is the preferred method for outdoor applications. Mount the unit as close to the electrical service entrance as possible. Attach the supplied angle bracket to a suitable mounting surface (pole, wall, etc.) using self-tapping screws or nails. Place the wires and the threaded neck of the unit through the 7/8-inch hole in the bracket with the wires pointing down. Thread the locknut onto the neck and tighten securely.

c. Wiring Connections

For best protection, make the lead connections as short as possible. Connect the white lead on Model TLN4399A or the green lead on Model TLN5920A to ground and the black lead of either model to the "hot" side of the line.

NOTE

Failure to follow the grounding instructions will prevent the unit from properly protecting your equipment.

d. Grounding Instructions

On all installations, check the circuit ground to make sure that it is properly grounded. A No. 8 wire, or larger, should be connected from the fuse box or mounting bracket to an 8-foot ground rod or equivalent.



MOTOROLA INC.
Communications Division

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10. OPERATING INSTRUCTIONS

10.1 INTRODUCTION

10.1.1 The Advanced Trunked *SYNTOR* X FM Two-Way Radio Control Station is designed to operate in both 800 MHz trunked and conventional systems. The control station is fully equipped to operate on up to 20 channels in a Motorola Trunked System, and also has the capability to access up to 10 conventional channels.

10.1.2 A basic control station can be programmed for operation in either the subfleet mode or in the fleet-call mode. When in the subfleet mode, the control station communicates only with units of a specified subfleet. The fleet-call mode allows the station to receive all subfleets within the fleet on a first-in-first-out (FIFO) scan basis. Also, all calls initiated by the control station will be received by all subfleets within the fleet. A code plug is used for programming the control station as required. The Installation section contains more information on the code plug (paragraph 9.7).

10.2 ALERT TONES

The following alert tones aid the operator by indicating unique system conditions:

-- System Busy - Telephone type busy signal. If heard upon depressing the PTT (push-to-talk) button, indicates that you can not transmit because all radio channels in the system are in use.

-- Automatic Call Back - Beeps heard while radio is in receive mode, indicating that a channel is now available for your previously requested transmission.

-- Talk Prohibit - Continuous tone, heard while the PTT button is depressed, indicating that either you are out of range of the trunked radio system, or that the system is out of service.

-- Failsoft - Beep heard every 10 seconds in an unmuted receive mode. Indicates failure of the system central controller. The radio reverts from trunked operation to a system similar to conventional radio repeater operation. During failsoft operation, you may be sharing the channel with other users and temporarily lose the privacy feature.

-- Talk Permit (optional) - Short tone burst, heard upon depressing the microphone PTT button, verifies that the system is accepting your transmission.

-- Time-Out-Timer Alert - Beep which indicates that your present transmission will soon be disabled.

-- *Private Conversation* Call Capability (optional) - Two high-pitched tone bursts indicating a private call has been received.

-- Individual *Call Alert* Paging (optional) - High-pitched beep every 5 seconds which indicates that the radio is being paged.

-- Central Acknowledge (optional) - One high-pitched tone burst indicating that an Individual *Call Alert* page or Emergency Alarm has been received by the system central controller.

-- Dynamic Reprogramming (optional) - A unique chirp indicating when a dynamic ID has been received. If the user has not selected the "reprogrammed" subfleet, this chirp will be heard every time the microphone PTT button is pushed.

-- Illegal Key Tone - A low pitched tone heard after a keypad is depressed indicating that the keypad pressed is not valid.

10.3 BASIC CONTROL STATION OPERATION (Refer to Operating Overview Diagram 11-, 13-SP5290317.)

10.3.1 Powering the Local Trunked Desk Set

10.3.1.1 It is assumed that the control station has been properly installed, is plugged into an ac outlet, and that its green Power On indicator (in the upper left hand corner) is lit indicating that it is properly powered. If the Local Trunked Desk Set is AC powered, it is also assumed that it is plugged into an ac outlet.

10.3.1.2 The display of the local trunked desk set should be on unless the local trunked desk set is in Sleep Mode. If the display is not on, depress any key on the local trunked deskset keypad and it should come on.

NOTE

For information on Sleep Mode, refer to the instruction manual supplied with the desk set.

10.3.2 Setting the Local Trunked Desk Set Attributes

The local trunked desk set user can vary several local attributes such as speaker volume and microphone gain. These are changed by using the local control menu which is accessed by using the **CTRL** key. For a complete description of the local control menu operation, refer to the Instruction Manual supplied with the desk set.

10.3.3 Error Message

10.3.3.1 The word **ERROR** will be displayed in the lower left hand corner of the local trunked desk set display whenever a local trunked deskset has lost data communication with the control station. Communications may be interrupted for one of several reasons such as:

-- Several local trunked desk set users are attempting to control the control station at the same time.

-- Extremely rapid, successive key depressions.

-- The control station power has been interrupted.

-- The data bus between the control station and the local trunked desk set has been interrupted.

10.3.3.2 Usually the error message will only be temporary and communications will be quickly restored. If, however, the error message remains, first check that the control station is still powered on and that the data bus is still connected to the control station and to the local trunked desk set. If power is on, the connections are correct, and the error message remains, turn the control station power off. Wait 2 minutes, and then restart the control station. If the error message still persists, contact service personnel.

10.4 LOCAL TRUNKED DESK SET KEYPAD OPERATION (Refer to Operating Overview Diagram 11-, 13-SP5290317.)

10.4.1 All control station functions from the desk set are entered through the desk set keypad (with the exception of the handset transmit bar), and are converted to digital data signals which are sent to the control station.

10.4.2 The keypad provides an audible "click" (level is user adjustable), when keys are depressed. The "click" is also provided when certain keys are released (**TRANSMIT**, **MONITOR**, **SUPERVISOR**, and **INTERCOM**). The "click" provides audible feedback to the user that the key has been depressed or released.

10.5 OPTIONS

Most radio options are ordered on a system number/personality basis. In other words, each system number/personality can have its own set of options. The user **does not** have access to options which are not ordered for a system/personality, and those options are not displayed in the menu for the system/personality.

10.6 TO TRANSMIT

10.6.1 To Transmit In A Trunked System

-- Lift the handset off-hook, and then press and hold the **TRANSMIT** bar on the handset.

-- If you hear a telephone-type busy signal, all channels are in use. Release the **TRANSMIT** bar and wait for the call back tone.

-- If no busy tone is heard, speak slowly into the handset microphone in a normal voice. The characters **TX** will appear in the upper left hand corner of the display to indicate that you are transmitting.

The user can optionally order an internal microphone to enable transmitting with the handset on-hook. To transmit on-hook with this option:

nn = system number
1 = subfleet letter
d = call list digit
uuuuuu = unlimited ID number
SYS etc. = flashing

PVT	1
PVT	uuuuu
PVT	1
ALERT	uuuuu
ALERT	uuuuu
EMER	nn
SYS WIDE	nn
SUPV OVERRIDE	nn

INTERNAL MICROPHONE
(OPTIONAL)

TRANSMIT BAR
(PUSH TO TALK)

Press to initiate transmissions.

INTERCOM

Press to intercom with other Local Trunked Deskset users.

SUPV

Press to enter supervisor takeover function. (NOTE: Only functions if unit is supervisor deskset).

EMERG

Press to enter emergency call and alarm functions.

MONITOR

Press to monitor a conventional channel before transmitting.

TRANSMIT KEY
(PUSH TO TALK)

Press to initiate transmissions.
NOTE: Only functions if internal microphone option is ordered).

SPEAKER

MENU

Press **MENU** key to select function or to exit selected function.
SELECT FUNCTIONS
System and Fleet
Subfleet
Scan
Private Conversation
Call Alert

STEP

Press to select function values. Press key once to advance to next function value.

CTRL

Press to enter local control menu.

KEYS 0 THRU 9

System Select — press to select desired system.
Subfleet Select — press to select desired subfleet.
Private Call/Call Alert — press to enter in call list number or unlimited ID.

Press to clear display to enter an unlimited ID.
Press to exit local control menu.

#

STORE/O

Press after release of **SUPV** to lock in supervisor takeover function.

SYMBOL TABLE:

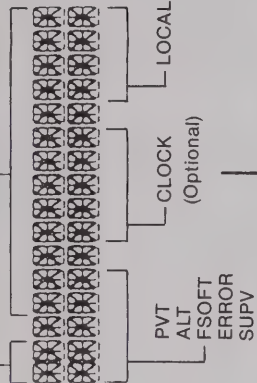
nn = system number
1 = subfleet letter
d = call list digit
uuuuu = unlimited ID number
SYS etc. = flashing

PVT 1
PVT
PVT
ALERT 1
ALERT
SYS WIDE nn
SUPV OVERRIDE nn

SUB 1
RP
TA
SUB 1
SUB 1
RP
TA

SYS
SYS
SYS
SYS
SYS
SYS

TX - transmit indicate
IC - intercom on



PRIVACY PLUS™ L1261A TRUNKED EXTENDED LOCAL DESK SET

SPEAKER

MENU

Press **MENU** key to select function or to exit selected function.
SELECT FUNCTIONS
System and Fleet
Subfleet
Private Conversation
Call Alert

STEP

Press to select function values. Press key once to advance to next function value.

CTRL

Press to enter local control menu.

KEYS 0 THRU 9

System Select — press to select desired system.
Subfleet Select — press to select desired subfleet.
Private Call/Call Alert — press to enter in call list number or unlimited ID.

#

Press to clear display to enter an unlimited ID.
Press to exit local control menu.

STAR

Press to exit any function and return to Subfleet Select. If in Subfleet Select or Idle, press to go to System Select.

STORE/O

Press after release of **SUPV** to lock in supervisor takeover function.

INTERNAL MICROPHONE
(OPTIONAL)

TRANSMIT BAR
(PUSH TO TALK)

Press to initiate transmissions.

INTERCOM

Press to intercom with other Local Trunked Deskset users.

SUPV

Press to enter supervisor takeover function. (NOTE: Only functions if unit is supervisor deskset).

MONITOR

Press to monitor a conventional channel before transmitting.

TRANSMIT KEY
(PUSH TO TALK)

Press to initiate transmissions. (NOTE: Only functions if internal microphone option is ordered).

-- Keep or place the handset on-hook.

-- Press and hold down the **TRANSMIT** key on the front keypad.

-- If you hear a telephone-type busy signal, all channels are in use. Release the **TRANSMIT** key and wait for the call back tone.

-- If no busy tone is heard, speak slowly into the internal microphone in a normal voice. The characters **TX** will appear in the upper left hand corner of the display to indicate that you are transmitting.

NOTE

The keypad **TRANSMIT** key is only functional if the internal microphone option is ordered. If the internal microphone option is not ordered, the keypad **TRANSMIT** key is inoperative.

10.6.2 To Transmit In A Conventional System

If the selected conventional channel does not use carrier squelch operation, depress the **MONITOR** key to disable the PL or DPL decoder and listen to the channel. When the channel is not in use, lift the handset off hook, press and hold the **TRANSMIT** bar, and begin the conversation. If the internal microphone option is ordered, the user may also leave the handset on-hook and use the **TRANSMIT** key. In either case, the characters **TX** will appear in the upper left hand corner of the display to indicate that the user is transmitting.

10.7 TO RECEIVE (Trunked and Conventioanl Systems)

To receive, release the **TRANSMIT** key or bar. If the handset is on-hook, received messages are heard through the desk set speaker. If the handset is off-hook, received messages are heard through the earpiece speaker in the handset.

10.8 MODES OF OPERATION

10.8.1 System and Fleet Selection

This function is used to select a trunked fleet or 800 MHz Conventional System.

10.8.1.1 To select a new system:

-- Press the **MENU** or ***** key until the word **SYS** appears flashing in the upper left hand corner of the display, followed by the number of the current system. If the current system is a trunked system, the flashing **SYS** and system number is followed by the word **SUB**, and a letter corresponding to the subfleet selected. If the current system is a conventional system, the system number is followed by either a **RP** or a **TA**. **RP** stands for repeater and **TA** for talkaround (unit to unit) use on conventional channels.

NOTE

Talkaround operation requires special FCC licensing.

-- Press the **STEP** key until the display is incremented to the desired system, or use the keypad to directly enter the value. When using the keypad, the first digit pressed appears flashing in the display for up to 2 seconds. If an additional digit is entered within this 2 second period, then that 2 digit number is accepted as the system number input; otherwise, the single digit is accepted as the system number input. If the system defined by the system number entered is valid, the radio goes to that system. If the system number is not valid, the radio reverts to the last valid system displayed and the illegal key tone is heard.

10.8.1.2 After a period of 10 seconds without activity, the local trunked desk set display reverts to the **IDLE** state, and the **SYS** prompt stops flashing. Once this happens, the user can no longer enter a new system number. To go directly back to system select function, press the ***** key.

10.8.2 Subfleet Selection

Subfleet select allows the control station operator to communicate with members of a desired trunked subfleet. Each trunked fleet has its own unique subfleet(s). Subfleet select can only be accessed when operating in a trunked system.

10.8.2.1 To Select A Trunked Subfleet

-- Press the **MENU** or ***** key until the digits **SUB** appear flashing in the upper display. The flashing **SUB** is preceded by the **SYS** prompt and system number.

-- Press the **STEP** key until the display is incremented to the desired subfleet, or use the keypad to directly enter the value. Repeated pressing of a letter associated key steps through each of the three assigned letters. Attempting to enter a subfleet which is not valid results in an illegal key tone.

-- Subfleet **R** designates the reprogram request position and should only be used to send reprogramming requests (see section 10.15.2.)

-- Subfleet **X** represents the dynamic position when the control center has been dynamically regrouped (see section 10.15.1).

10.8.2.2 After a period of 10 seconds without activity, the local trunked desk set display reverts to the **IDLE** state and the **SUB** prompt stops flashing. Once this happens, the user can no longer enter a new subfleet letter. To go directly back to subfleet select function, press the **MENU** key, or press the ***** key twice.

10.9 SCAN (Optional)

This optional feature allows the user to scan subfleets within a trunked system. At the time of order, a scan list is determined by the customer for some or all of the systems.

NOTE

A control station may have a different scan list for each system.

-- Press the **MENU** key until the upper display shows **SCAN**. **SCAN** is followed by a system number and a subfleet letter.

-- After a delay of 2 seconds, the control station begins scanning. The subfleet letter or system digit changes to reflect the fact that the control station is scanning.

-- When activity is found, the display reflects the trunked subfleet on which the activity was found.

-- Any transmissions made while the control station is scanning are made on the fleet/subfleet channel that the radio was on **immediately before** entering the scan function.

10.10 *PRIVATE CONVERSATION* (optional)

This optional feature allows the user to privately call other units. *Private Conversation* can only be accessed when operating in a trunked system.

10.10.1 Sending A Private Call

10.10.1.1 Non-Supervisor Private Call

This option allows the control station user to place a private call to one other person.

-- Press the **MENU** key until the word **PVT** is displayed on the upper display.

-- Depress the **TRANSMIT** key or bar, pause for a second to allow the alert tone to be received at the individual unit being called, and then begin the conversation.

10.10.1.2 Multiple *Private Conversation*

This option allows the control station user to privately call as many as eight people, one at a time.

-- Press the **MENU** key until the word **PVT** is displayed on the upper display, followed by the number **1**.

-- Select the individual to be called (1-8) by pressing the **STEP** key or by direct entry from the keypad.

-- Depress the **TRANSMIT** key or bar, pause for a second to allow the alert tone to be received at the individual unit being called, and then begin the conversation.

10.10.1.3 *Unlimited Private Conversation II*

This option allows the control station user to privately call any unit in the system.

-- Press the **MENU** key until the word **PVT** is displayed on the upper display, followed by a 6 digit number, or 6 dashes.

-- If the 6-digit number is the number of the individual that is to be called, simply depress the **TRANSMIT** key or bar to transmit as in the other implementations of private call.

-- If a new 6-digit number must be entered, or if dashes are displayed on entry to this function, first depress the **#** key. After doing this, the display will show 6 dashes. Use the keypad to enter in the desired 6-digit number. Once 6-digits are entered, depress the **TRANSMIT** key or bar to talk to the other party.

-- If an error is made while entering a 6-digit number, the **STEP** key may be used to delete the last digit entered. Successive presses of the **STEP** key deletes previously entered digits. Deleting the last digit will change the display to the last complete 6-digit ID entered.

-- The user is only allowed to transmit when a complete 6-digit ID is displayed. If the user depresses the **TRANSMIT** key or bar when there are less than 6-digits displayed, an illegal key tone will be heard.

-- If the user enters an invalid ID, an illegal key tone is heard after the 6th digit is keyed in, and transmission is not allowed.

10.10.2 Receiving A Private Call

When a private call is received, an alert tone (two high-pitched tone bursts) sounds and the word **PVT** flashes in the lower left hand corner of the display. To respond to the private call, press the **MENU** key until the **PVT** annunciator appears in the upper display. If the control station is not a non-supervisor PC I unit, the **PVT** prompt will be followed by a **0** to indicate that the control station has received a private call, and will talk to the individual that called.

10.10.3 Terminating A Private Call

Press the **MENU** or ***** key to exit the function.

10.11 *CALL ALERT* (optional)

The *Call Alert* decode option allows the control station to receive *Call Alert* pages from other units in the system and to send a *Call Alert* page to other units in the system. *Call Alert* can only be accessed when operating in a trunked system.

10.11.1 *Call Alert Decode*

When a *Call Alert* is received, an alert tone (four high-pitched tone bursts) sounds and the word **ALT** flashes in the lower left hand corner of the display. The **ALT** indicator remains flashing and the alert tone is repeated approximately every 5 seconds until the operator acknowledges the page by depressing the **TRANSMIT** key or bar.

10.11.2 *Call Alert Encode*

There are two implementations of this feature.

10.11.2.1 *Multiple Call Alert*

Multiple Call Alert allows the control station user to *Call Alert* one of up to 8 different individuals.

-- Press the **MENU** key until the word **ALERT** is displayed on the upper display, followed by the number 1.

-- Select the individual to be called (1-8) by pressing the **STEP** key or by direct entry from the keypad.

-- Depress the **TRANSMIT** key or bar momentarily and release it. If five alert tones are heard, then the selected individual received the *Call Alert*. If only a single alert tone is heard, the receiving unit did not receive the page. Try again.

NOTE

The receiving unit may not have received the page for one of the following reasons:

- Unit turned off
- Unit is out of range
- Unit engaged in conversation on voice channel.

10.11.2.2 *Unlimited Call Alert*

This feature allows the control station user to *Call Alert* any individual in the system.

-- Press the **MENU** key until the word **ALERT** is displayed on the upper display, followed by a 6-digit number or 6 dashes.

-- If the 6-digit number is the number of the individual that is to be alerted, simply depress and release the **TRANSMIT** key or bar to send the *Call Alert* as explained in Section 10.11.2.1.

-- If a new 6-digit number must be entered, or if dashes are displayed on entry to this function, first depress the **#** key. After doing this, the display will show 6 dashes. Use the keypad to enter in the desired 6-digit number. Once 6-digits are entered, depress and release the **TRANSMIT** key or bar to send the *Call Alert* page as explained in Section 10.11.2.1.

-- If an error is made while entering a 6-digit number, the **STEP** key may be used to delete the last digit entered. Successive presses of the **STEP** key deletes previously entered digits. Deleting the last digit will change the display to the last complete 6-digit ID entered.

-- The user is only allowed to transmit when a complete 6-digit ID is displayed. If the user depresses the **TRANSMIT** key or bar when there are less than 6-digits displayed, an illegal key tone will be heard.

-- If the user enters an invalid ID, an illegal key tone is heard after the 6th digit is keyed in and the user will not be allowed to transmit.

10.11.3 Terminating Call Alert

-- Press the **MENU** or ***** key to exit the function.

-- After 30 seconds in the *Call Alert* mode, the mobile radio will automatically revert to the **IDLE** (dispatch) state to prevent accidentally missing dispatch calls.

10.12 EMERGENCY CALL AND ALARM (Optional)

The Emergency Call and Alarm options allow the control station user to have channel access during emergency situations. Emergency Call and Alarm can only be accessed when operating in a trunked system. Depending on the customer selection at the time of order, three possible Emergency operational options are available:

- A. Emergency Call Only; takes place on a voice channel
- B. Emergency Alarm Only; takes place on the control channel
- C. Emergency Call/Alarm combination.

10.12.1 Emergency Call Only Option

To make an emergency call only:

-- Depress the **EMERG** key. The display will show **EMER** followed by the system and subfleet that the control station is operating in.

-- Depress the **TRANSMIT** key or bar to obtain a voice channel and begin conversation.

-- After the call is complete, depress the **MENU** or ***** key to exit the emergency function.

10.12.2 Emergency Alarm Only Option

To make an emergency alarm only call:

-- Depress the **EMERG** key. The display will show **EMER** followed by the system and subfleet that the control station is operating in. The emergency alarm is automatically sent. No further action is required by the operator.

-- A central acknowledgement tone is heard by the operator as an indication that the system central controller has received the alarm.

-- After the alarm is complete, depress the **MENU** or ***** key to exit the emergency function.

NOTE

If the **TRANSMIT** key or bar is depressed while in the Emergency Alarm Only mode, the operator will hear a Talk Prohibit Tone.

10.12.3 Emergency Call/Alarm Combination

To make an emergency call/alarm combination call:

-- Depress the **EMERG** key. The display will show **EMER** followed by the system and subfleet that the control station is operating in.

-- An emergency alarm is automatically sent. A central acknowledgement tone is heard by the operator as an indication that the system central controller has received the alarm.

-- Depress the **TRANSMIT** key or bar and a voice channel will be assigned. Voice communications may then begin.

-- After the call is complete, depress the **MENU** or ***** key to exit the emergency function.

NOTE

The system number and subfleet letter remain displayed in the emergency modes as a reminder of what system and subfleet the radio is operating in.

10.13 INTERCOM FEATURE

The Intercom feature allows the user of one local trunked desk set to communicate with all other local trunked desk set users connected to the same control station. To use the Intercom feature:

-- Remove the handset off hook. Depress and hold the **INTERCOM** key, and talk. If the local trunked desk set has the optional internal microphone, the operator need not lift the handset off-hook to intercom but simply depress the **INTERCOM** key and talk. In either case, the characters IC will appear in the upper left hand corner of the display as an indication that intercom is active.

NOTE

The IC symbol appears in the display of all local trunked desk sets connected to the same control station not just the local trunked desk set that initiated the intercom.

-- If a transmission is received while the intercom is on, the intercom will be automatically turned off so that the user can hear the received message.

-- If a user depresses **INTERCOM** when a transmission is being received, the illegal key tone is heard and no intercom can take place.

-- If a user depresses **INTERCOM** while another local trunked desk set already has their **INTERCOM** depressed, the user will receive an illegal function tone and will not be allowed to intercom.

-- The intercom function is automatically overridden if another local trunked desk set decides to transmit.

10.14 SUPERVISOR TAKEOVER FEATURE

This feature allows a local trunked desk set user to take control of all other local trunked desk sets connected to the same control station.

10.14.1 Designating the Supervisor Local Trunked Desk Set

Only a local trunked desk set that has been designated as the Supervisor can access the Supervisor Takeover function. See the local trunked desk set instruction manual for details on how to set the unit ID so that the unit is a Supervisor.

NOTE

There can only be one Supervisor local trunked desk set connected to a control station since every local trunked desk set must have a unique unit ID.

10.14.2 Activating Supervisor Takeover

To activate the Supervisor Takeover function, the user of the supervisor local trunked desk set must depress and hold the **SUPV** key. The word **SUPV** will be displayed in the lower left hand corner of the display as an indication that the Supervisor Takeover function is active.

The Supervisor Takeover function can be "locked in" by releasing the SUPV key and then depressing the 0 key within 2 seconds of the release of the SUPV key.

10.14.3 Operation During Supervisor Takeover

10.14.3.1 Supervisor Local Trunked Desk Set

The user of the supervisor local trunked desk set has all features available that are normally available.

10.14.3.2 Non-Supervisor Local Trunked Desk Sets

When the supervisor local trunked desk set enters the Supervisor Takeover function, the top line of the display at all other local trunked desk sets will show the message **SUPV OVERRIDE** to indicate that the supervisor has overridden their operation. As long as this message is displayed, all that the non-supervisor local trunked desk sets can do is initiate the intercom feature. If they were transmitting when the Supervisor Function was entered, their transmission is discontinued. During supervisor takeover, non-supervisor local trunked desk sets hear all received messages, hear any transmissions from the supervisor desk set, and hear all intercom audio.

10.14.4 Exiting Supervisor Takeover

If holding the SUPV key, release it. If Supervisor Takeover has been locked in, press and then release the SUPV key. The Supervisor Takeover function ends 2 seconds after the SUPV key is released.

10.15 DYNAMIC REGROUPING AND REPROGRAM REQUEST OPTION

This option allows the dispatcher to temporarily reassign individuals operating in separate subfleets, to "reprogram", or "regroup" in one communication subfleet. Dynamic regrouping and reprogram requests can only be accessed when operating in a trunked system.

10.15.1 Receiving Dynamic Reprogramming (Regrouping) ID Assignment

10.15.1.1 When a dynamic reprogramming ID assignment is received, an alert "chirp" is heard at the local trunked desk set to indicate that the control station has been assigned a new ID.

10.15.1.2 At the same time, the subfleet field of the display shows subfleet X to visually indicate the fact that the control station has been assigned and is now operating on the dynamic ID.

10.15.1.3 If the mobile radio is **SELECT ENABLE**, then the local trunked desk set user can move between the dynamic subfleet position and the other valid subfleets and can access all other features.

10.15.1.4 If the mobile radio is **SELECT DISABLE**, then the local trunked desk set user cannot select a new subfleet or a new trunked system. The local trunked desk set user, however, can still move to subfleet R to send a reprogram request and can still select a conventional system.

10.15.2 Requesting Dynamic Reprogramming (Regrouping)

The local trunked desk set user may request reprogramming by entering subfleet R while in the subfleet select mode. Once in subfleet R, the user depresses the **TRANSMIT** key or bar to send the reprogramming request. When the system central controller acknowledges the reprogram request, an acknowledgement tone is heard, and the subfleet changes from R to the first valid subfleet. When the dispatcher acknowledges the reprogram request, another acknowledgement tone is heard.

10.16 **FAILSOFT OPERATION**

When the control station is operating in a trunked system whose system central controller has become inoperative, the control station will revert to fail-soft operation. When this occurs, the control station users will hear a beep every 10 seconds and the message **FSOFT** will be displayed in the lower left hand corner of each local trunked desk set display. During this time, the control station is operating in a conventional mode, and the trunked system features (such as *Private Call*, *Call Alert*, and *Emergency Call*) are not functional.

NOTE

When in Failsoft operation, the system loses most of its fleet and subfleet privacy, but this privacy will be resumed as soon as normal system operation is restored.

10.17 **OPTIMIZATION OPTION (L461AB-SP)**

10.17.1 General

The -BMSP06 Trunked Control Station can become a Test and Optimization *Consolette* Radio when ordered with Option L461AB-SP (similar to older Model L35VBB5174AM-SP804 Test *Consolette*). Up to 20 carrier squelch frequencies can be programmed along with 6 trunked systems. The trunked systems are dispatch only and no advanced features can be ordered with the trunked personalities; therefore, the user may want to order a trunked system to allow verification of correct optimization by actually talking on a trunked channel.

10.17.2 Operation

The channels accessed by the desk sets are given in the following table:

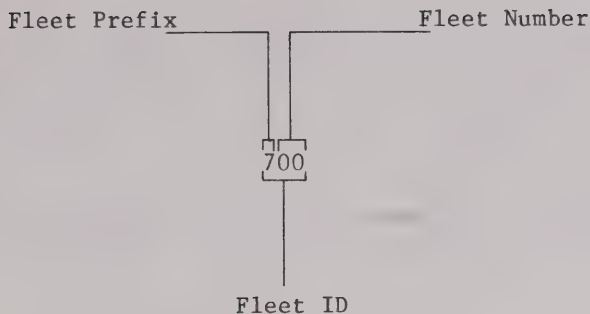
DISPLAY SHOWS**CHANNEL**

SYS 1-RP	CONVENTIONAL FREQUENCY #1
SYS 2-RP	CONVENTIONAL FREQUENCY #2
SYS 3-RP	CONVENTIONAL FREQUENCY #3
SYS 4-RP	CONVEITIONAL FREQUENCY #4
SYS 5-RP	CONVENTIONAL FREQUENCY #5
SYS 6-RP	CONVENTIONAL FREQUENCY #6
SYS 7-RP	CONVENTIONAL FREQUENCY #7
SYS 8-RP	CONVENTIONAL FREQUENCY #8
SYS 9-RP	CONVENTIONAL FREQUENCY #9
SYS 10-RP	CONVENTIONAL FREQUENCY #10
SYS 11-RP	CONVENTIONAL FREQUENCY #11
SYS 12-RP	CONVENTIONAL FREQUENCY #12
SYS 13-RP	CONVENTIONAL FREQUENCY #13
SYS 14-RP	CONVENTIONAL FREQUENCY #14
SYS 15-RP	CONVENTIONAL FREQUENCY #15
SYS 16-RP	CONVENTIONAL FREQUENCY #16
SYS 17-RP	CONVENTIONAL FREQUENCY #17
SYS 18-RP	CONVENTIONAL FREQUENCY #18
SYS 19-RP	CONVENTIONAL FREQUENCY #19
SYS 20-RP	CONVENTIONAL FREQUENCY #20
SYS 21-RP	CONVENTIONAL FREQUENCY #21
SYS 22-RP	CONVENTIONAL FREQUENCY #22
SYS 23-RP	CONVENTIONAL FREQUENCY #23
SYS 24-RP	CONVENTIONAL FREQUENCY #24
SYS 25-RP	CONVENTIONAL FREQUENCY #25
SYS 26-RP	CONVENTIONAL FREQUENCY #26

With judicious use of the multiple frequency capability and external gated detector output, system optimization can be simplified. For additional details refer to the System Optimization information contained in the Trunked Simulcast System manual 1000S-SP3770025.

11. CALCULATION OF 6-DIGIT PERSONALITY (INDIVIDUAL) ID'S**11.1 GENERAL**

Every radio has a unique identification which consists of a fleet ID, personality ID, and a size code letter. To use the Unlimited *Private Conversation II* or Unlimited *Call Alert* Options (when so ordered) from the companion trunked local desk set, each radio's unique identification must be represented by a 6-digit decimal number. This decimal number is derived from a binary number which contains a FLEET PREFIX field, a FLEET NUMBER field, a PERSONALITY field, and a SIZE CODE field. The fleet prefix and the fleet number are derived from the fleet ID as shown in the following example.



The fleet ID and the personality ID numbers in the Trunked Code Management System (TCMS) data base are in hexadecimal. Follow the steps below to determine the 6-digit decimal number corresponding to any given radio identification.

Step 1. In Table 1 find the size code for the given identification. This size code, when converted to a 5-bit long binary number comprises the size code field.

Step 2. The number of bits in each field depends upon the size code of the given identification. For the given identification size code, determine how many bits are in each of the 3 other fields by using Table 1.

Step 3. Represent the fleet prefix number as a 3-bit long binary number. LEFT justify this binary number (Table 2) in the number of bits listed in Table 1 for the fleet prefix field. This binary number is the fleet prefix field.

NOTE

Bits which overflow the fleet prefix field on the right should be discarded (size code letters M, O, and Q).

Step 4. Represent the fleet number as a binary number. RIGHT justify this binary number in the number of bits listed in Table 1 for the fleet field. This binary number is the fleet number field.

Step 5. Convert the personality ID to a binary number. RIGHT justify this binary number in the number of bits listed in Table 1 for the personality ID field. This binary number is the personality ID field.

Step 6. Beginning from the left, combine the fleet prefix, fleet number and personality ID fields into one binary number. Add enough leading 0's (zeros) to make this binary number 14 bits long. If the number is already 14 bits long, there is no need to do anything to it.

Step 7. Append the binary number found in Step 6 to the right of the binary size code field to form a 19 bit long binary number.

Step 8. Convert the number found in Step 7 to its decimal equivalent. This decimal number is the 6-digit Unlimited *Private Conversation II*/Unlimited *Call Alert* ID.

TABLE 1. SIZE CODE FIELD SIZE TABLE

<u>SIZE CODE</u>			<u>NUMBER OF BITS PER FIELD</u>		
<u>LETTER</u>	<u>DECIMAL</u>	<u>BINARY</u>	<u>FLEET PREFIX</u>	<u>FLEET NUMBER</u>	<u>PERSONALITY ID</u>
A	0	00000	3	7	4
B	1	00001	3	4	6
C	2	00010	3	3	7
D	3	00011	3	0	9
E	4	00100	3	6	5
F	5	00101	3	5	5
G	6	00110	3	5	6
H	7	00111	3	4	7
I	8	01000	3	3	8
J	9	01001	3	2	8
K	10	01010	3	1	8
M	12	01100	2	0	10
O	14	01110	1	0	11
Q	16	10000	0	0	12

TABLE 2. HEXADECIMAL AND BINARY EQUIVALENTS

HEXADECIMAL	BINARY
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
A	1010
B	1011
C	1100
D	1101
E	1110
F	1111

11.2 EXAMPLE 1

A radio is assigned the following identification:

NOTE

All values shown are hexadecimal except size code number (decimal).

Fleet prefix number:	4
Fleet number:	none
Personality ID:	2F 0
Size code number:	14 (0)

Step 1. This radio has size code number 14. As a 5-bit long binary number, this is 01110. Therefore, the size code field is 01110.

Step 2. According to Table 1, for a size code of 14, there is:

- 1 bit in the fleet prefix field.
- 0 bits in the fleet number field.
- 11 bits in the personality ID field.

Step 3. The fleet prefix number of this radio is 4, which is binary 100. Left justifying this into 1 bit gives a fleet prefix field of 1.

NOTE

The two rightmost 0's (zeros) of 100 were discarded when 100 was left justified into a 1 bit long field.

Step 4. There is no fleet number field for a size code of 14.

Step 5. The personality ID of this radio is 2F0, which is binary 001011110000. Right justifying this into 11 bits gives a personality ID field of 01011110000.

Step 6. Beginning from the left combine the fleet prefix, fleet number, and personality ID into one large binary number:

1 + (None) + 01011110000 = 101011110000
 Fleet Prefix + Fleet Number + Personality ID

Since this number is only 12 bits long, 2 zeros are added on the left to give:

00101011110000

Step 7. Appending the number found in Step 6 to the right of the size code gives:

01110 + 00101011110000 = 0111000101011110000
 Size Code + # from Step 6

Step 8. Binary numbers can be converted to decimal numbers by recording the decimal value for each binary digit (read right to left) and adding the total decimal value for each binary digit. Table 3 shows the decimal equivalent for each digit (bit).

TABLE 3. BINARY TO DECIMAL CONVERSION

Bit Position	MSB																	LSB	
	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Bit Position Weighting	262144	131072	65536	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

For example, to convert binary 0111000101011110000 to decimal equivalent, proceed as follows:

BIT POSITION	BINARY VALUE	DECIMAL VALUE
1	0	0
2	0	0
3	0	0
4	0	0
5	1	16
6	1	32
7	1	64
8	1	128
9	0	0
10	1	512
11	0	0
12	1	2048
13	0	0
14	0	0
15	0	0
16	1	32768
17	1	65536
18	1	131072
19	0	0

SUM = 232176

Therefore, the Unlimited *Private Conversation II*/Unlimited *Call Alert* 6-digit decimal identification number for this radio is 232176.

11.3 EXAMPLE 2

A second example of how to derive a radio personality ID follows.

A radio is assigned the following identification:

NOTE

All values shown are hexadecimal except size code number (decimal).

Fleet prefix number: 5
Fleet number: 0B
Personality ID: 01F
Size Code Number: 4 (E)

Step 1. This radio has a size code number 4. As a 5-bit long binary number, this is 00100. Therefore, the size code field is 00100.

Step 2. According to Table 1, for a size code of 4, there are:

3 bits in the fleet prefix field.
6 bits in the fleet number field.
5 bits in the personality ID field.

Step 3. The prefix number of this radio is 5, which is binary 101. Left justifying this into 3 bits gives a fleet prefix field of 101.

Step 4. The fleet number of this radio is 0B, which is binary 00001011. Right justifying this into 6 bits gives a fleet number field of 001011.

Step 5. The personality ID of this radio is 01F, which is binary 000000011111. Right justifying this into 5 bits gives an individual field of 11111.

Step 6. Beginning from the left, combine the fleet prefix, fleet number, and personality ID into one binary number:

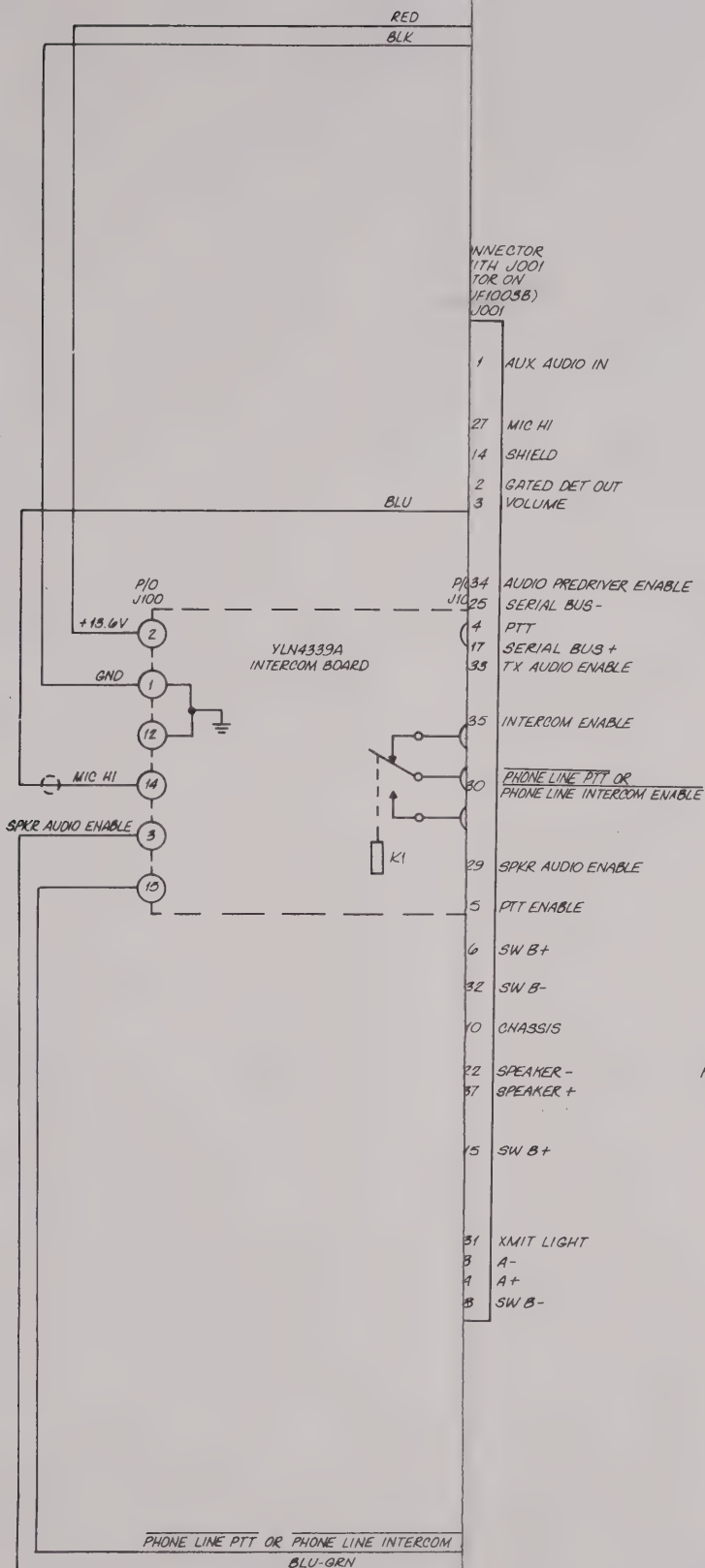
101	+	001011	+	11111	=	10100101111111
Fleet Prefix		Fleet Number		Personality ID		

Since this number is already 14 bits long, do nothing further to it.

Step 7. Appending the number found in Step 6 to the right of the size code number gives:

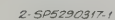
00100	+	10100101111111	=	001001010010111111
Size Code	+	# found in Step 6		Binary ID

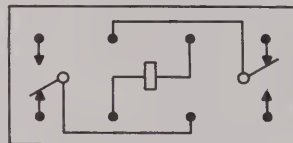
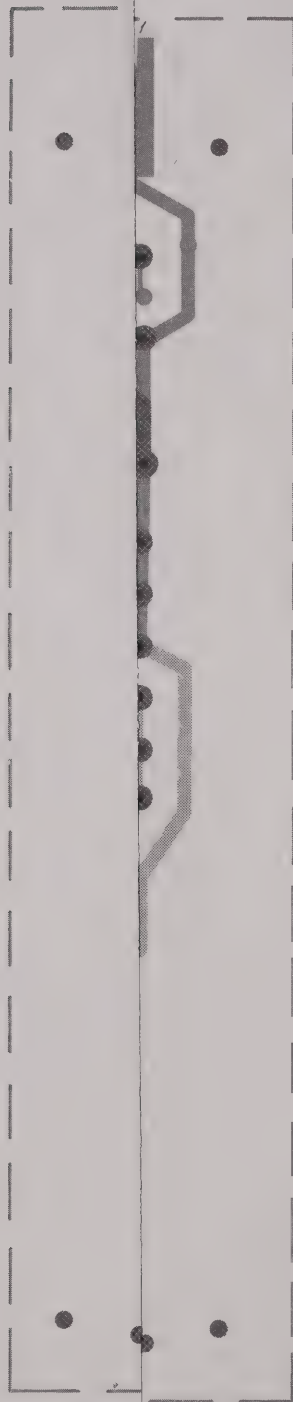
Step 8. The decimal equivalent of the number found in Step 7 is 76159. Right justifying this into 6 digits gives an Unlimited Call ID of 076159.



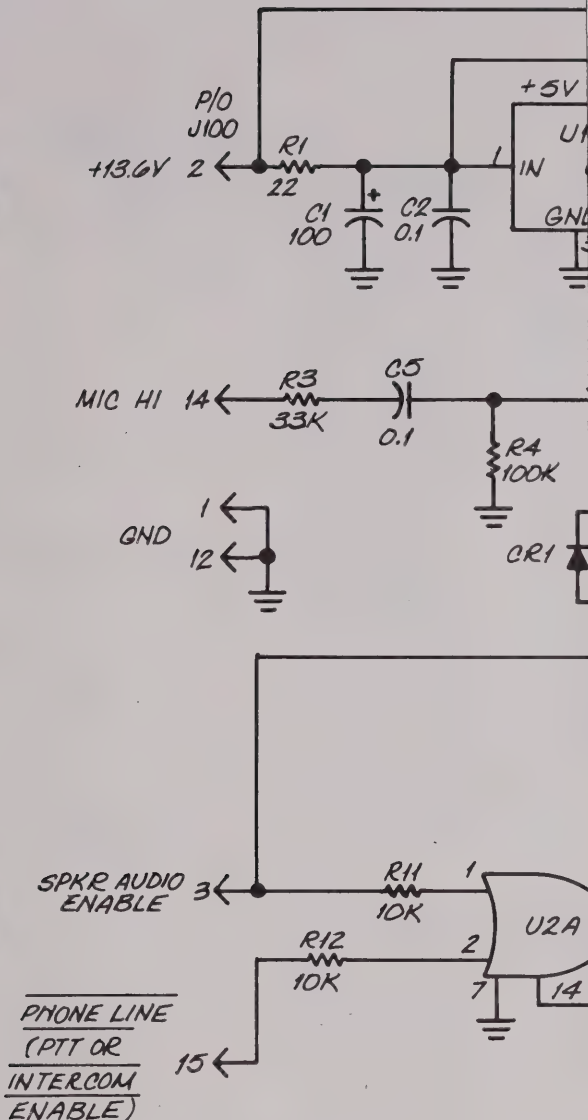
NOTES

1. WIRES ARE ROUTED TO, BUT NOT CONNECTED TO P101.





BOTTOM VIEW
OF K1



Motorola Part No.	Description
23-11019A46	capacitor:
21-82372C09	100 uF $\pm 20\%$; 25 V
23-11013D58	0.1 uF $\pm 80-20\%$; 25 V
8-11051A13	15 uF $\pm 20\%$; 20 V
	0.1 uF $\pm 5\%$; 63 V
48-83654H01	diode:
	silicon
1-80725T88	relay:
	relay with spacer
48-869919	transistor:
48-869642	FET; type M9919
48-869706	NPN; type M9642
	NPN Darlington; type M9706
6-11009A09	resistor (all $\pm 5\%$; 1/4 W):
6-11009A49	22
6-11009A85	1k
6-11009A97	33k
6-11009A93	100k
6-11009A97	68k
6-11009A83	100k
6-11009B06	27k
6-11009A73	220k
6-11009A49	10k
6-11009A73	1k
6-11009A73	10k
6-11009A84	30k
6-11009A73	10k
6-11009A73	10k
51-80068C01	integrated circuit:
51-82884L04	5 V regulator
	quad 2-input NOR gate
non-referenced item	
1-06705T25	Circuit Board Assembly

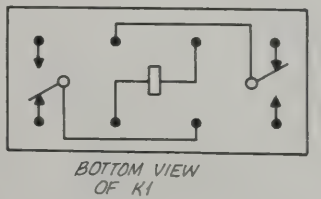
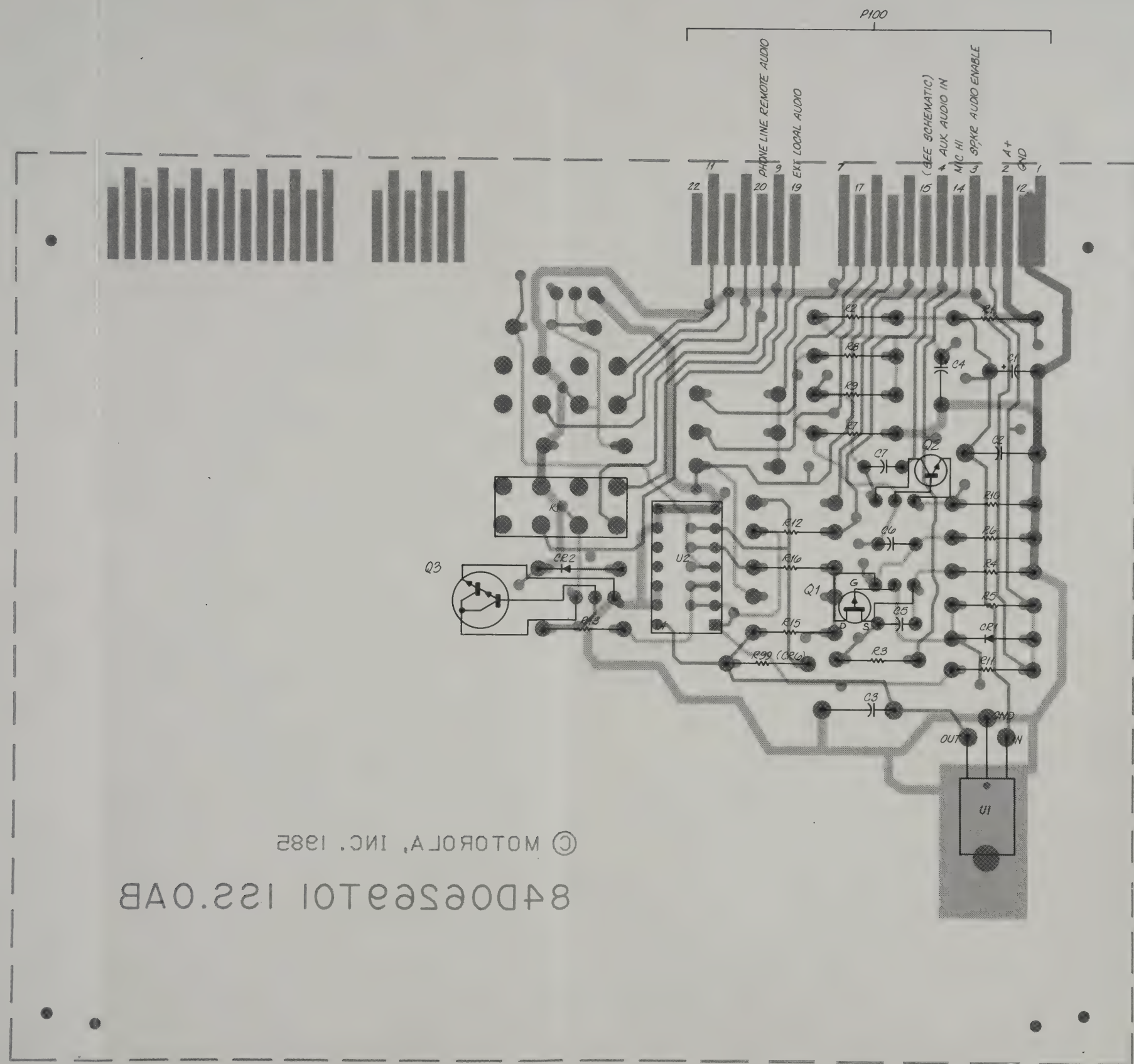
9642
9706

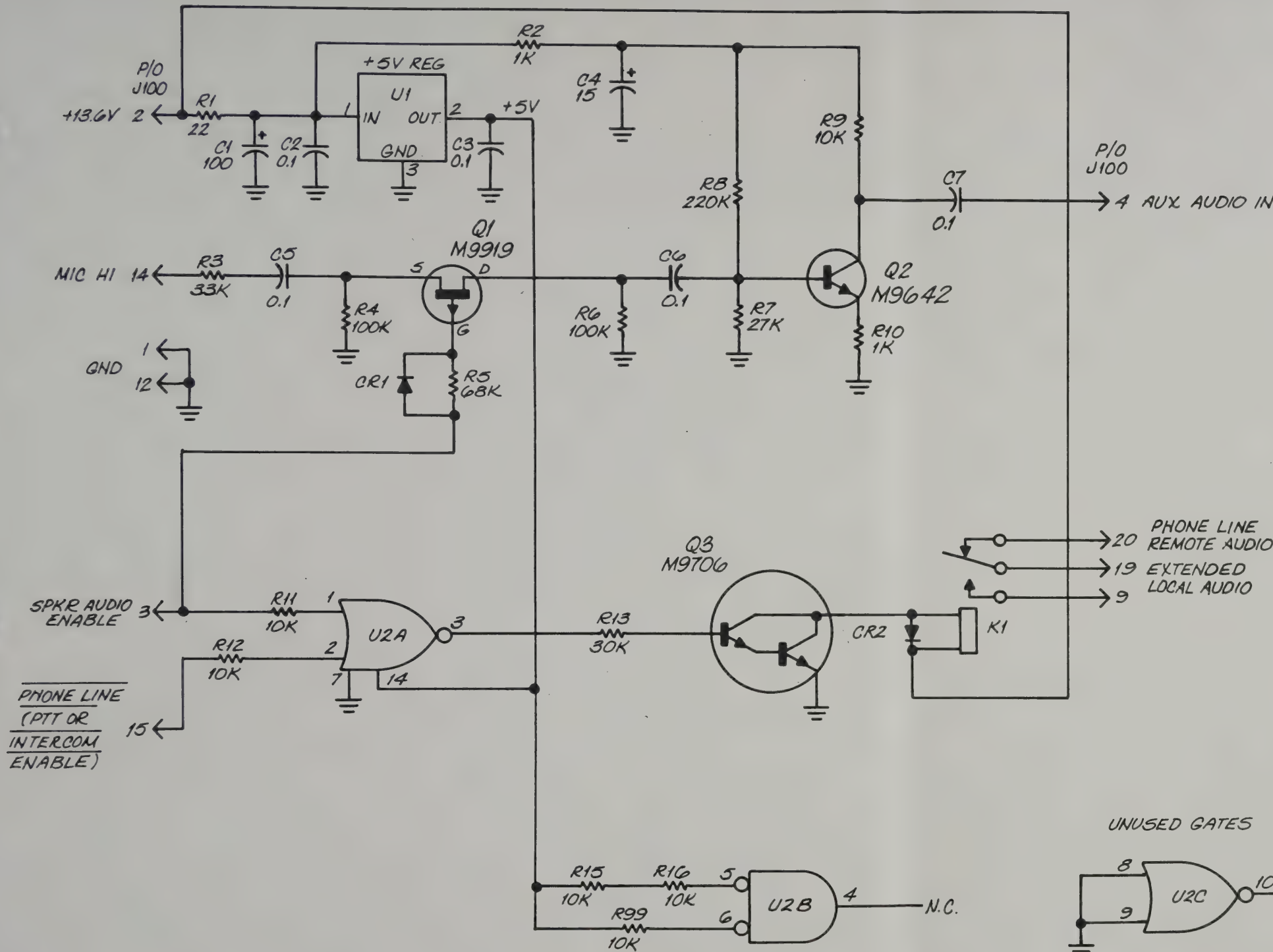
M9919

B C

S G D

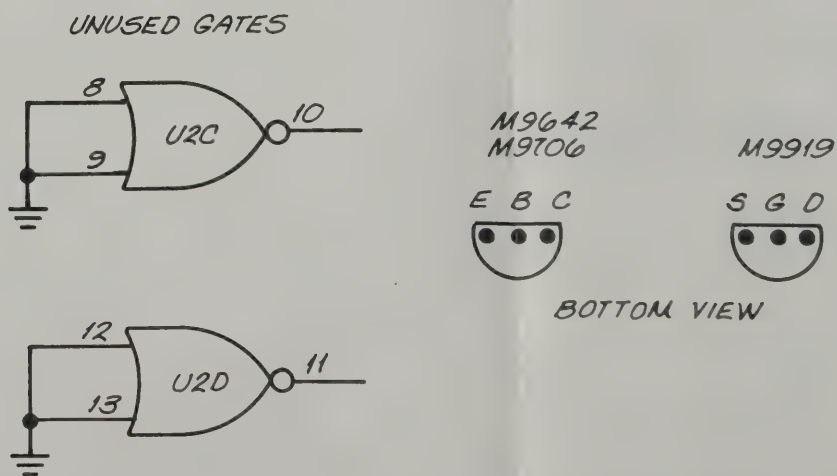
BOTTOM VIEW





PARTS LIST		
Reference Symbol	Motorola Part No.	Description
C1	23-11019A46	capacitor: 100 uF $\pm 20\%$; 25 V 0.1 uF $\pm 80-20\%$; 25 V 15 uF $\pm 20\%$; 20 V 0.1 uF $\pm 5\%$; 63 V
C2, 3	21-82372C09	
C4	23-11013D58	
C5, 6, 7	8-11051A13	
CR1, 2	48-83654H01	diode: silicon
K1	1-80725T88	relay: relay with spacer
Q1	48-869919	transistor: FET; type M9919 NPN; type M9642 NPN Darlington; type M9706
Q2	48-869642	
Q3	48-869706	
R1	6-11009A09	resistor (all $\pm 5\%$; 1/4 W): 22 1k 33k 100k 68k 100k 27k 220k 10k 1k 10k 30k 10k 10k
R2	6-11009A49	
R3	6-11009A85	
R4	6-11009A97	
R5	6-11009A93	
R6	6-11009A97	
R7	6-11009A83	
R8	6-11009B06	
R9	6-11009A73	
R10	6-11009A49	
R11, 12	6-11009A73	
R13	6-11009A84	
R15, 16	6-11009A73	
R99	6-11009A73	
U1	51-80068C01	integrated circuit: 5 V regulator quad 2-input NOR gate
U2	51-82884L04	
non-referenced item		
	1-06705T25	Circuit Board Assembly

NOTE: R99 LOCATED IN CR6 POSITION ON CIRCUIT BOARD.



PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R503	2-7087	Nut; 2 used
	2-83599D01	Nut, speed; 10 used
	2-83599D02	Nut, speed; 4 used
	3-3398	Screw, tapping; 6-20 x 3/8; 4 used
	3-134186	Screw, tapping; 6-32 x 5/16; 5 used
	3-134309	Screw, tapping; 4-40 x 3/16; 4 used
	3-140111	Screw, tapping; 10-32 x 5/16; 4 used
	3-488098	Screw, tapping; 8-18 x 3/8; 4 used
	3-83678N05	Screw, tapping; slotted star; 2 used
	4-1724	Washer, flat; .234 x .625 x .048
	4-122238	Washer, flat; .257 x 2.125 x .095
	6-126C13	Resistor; 33 ohms $\pm 10\%$; 1 W
	7-84101D01	Frame, front
	9-82778C01	Receptacle, lamp; 2 used
	15-83154G01	Cover, LT; 2 used
R501	17-82177B62	Resistor, WW; 16 ohms $\pm 10\%$; 10 W
C501	21-82187B14	Capacitor, disc; .001 uF $\pm 10\%$; 100 V
	43-84315M01	Standoff; 4 used
	64-82870K01	Panel, remote
	64-83123G02	Panel and bezel (assembled)
DS501, 502	65-82010C03	Bulb miniature; 14 V (2 used)
E501, 502	80-83029H01	Spark gap (2 used)
		<u>MECHANICAL ASSEMBLIES:</u>
R504	1-06704T65	Bracket, rivited; includes:
	2-1376	Nut, 3/8-32 x 1/2 x 3/32
	4-7698	Washer, lock; 3/8
	7-83714G01	Bracket
	18-82515B46	Resistor, variable; 25k $\pm 30\%$; 16 W
	31-127888	Terminal strip; 5 insulated, #4 GND
	1-06704T72	Cable and Connector; includes:
	3-140079	Screw, tapping; 6-19 x 1/2 (4 used)
	9-80227B01	Contact, female; PWR (2 used)
	9-84151B03	Receptacle, contact; (59 used)
	14-84556B02	Housing, connector; blue
	14-84590B01	Insulated connector, 5 contact; black
	15-80215B01	Connector, housing; front
	15-80216B01	Connector, housing; rear
	29-84706E05	Terminal; crimp pin
	36-80220B02	Knob
	42-10217A02	Strap, tie; (39 used)
	42-80156B01	Ring, retainer

PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	1-06705T28 9-84151B03 14-84556B01 42-10217A02	Cable, Intercom; includes: Receptacle, contact; (10 used) Housing, connector; black Strap, tie; 10 used
	1-80711D77 29-3014 31-120975 31-129354 31-135071 64-83117G03	Panel, riveted; includes Lug, solder; (6 used) Terminal strip, 8 insulated; #3 & #8 GND Terminal strip; 5 insulated; #3 GND Terminal strip; 9 insulated; #4 & #8 mounting Panel, front
	1-80720D70 4-7562 27-83668M01 29-3014 31-120975 31-136591 31-848187 75-864052	Chassis, riveted; includes: Washer, flat; .188 x .438 x .033 Chassis Lug, solder; (8 used) Terminal strip; 8 insulated; #3 & #8 GND Terminal strip; 9 insulated; #3 & #8 GND Terminal board; 10-terminal (2 used) Bumper, recess; (4 used)
	1-80720D71 9-83213K01 28-84579F04 30-84173E01	Coax cable and connector; includes: Connector; N type Plug; UHF Coax cable; double shielded

YRN4003A Remote Chassis and Panel

Parts List

Motorola No. 2PL-SP5290317-1

(Sheet 2 of 2) 11/4/85

PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	65-10266	<u>FUSE:</u> FUSE, 10A; 32V
	3-8022	<u>MECHANICAL PARTS:</u> SCREW, machine: 4-40 x 1/4"; 4 used
	3-127566	SCREW, hex machine: 10-32 x 1/4"; 2 used
	3-129890	SCREW, locking; 10-32 x 3/8 Hex machine; 4 used
	3-129954	SCREW, hex machine: 4-40 x 3/8"; 3 used
	3-131351	SCREW, tapping: 6-20 x 7/16"; 2 used
	3-83307G01	SCREW, machine: 10-32 x 1/2; flat; 2 used
	7-83669M01	BRACKET, power supply
	15-84922B03	HOUSING, white
	26-84773M01	SHIELD
	42-10128A10	RETAINER, ring, rubber; 2 used
	65-83241G01	JEWEL, red
	65-83241G02	JEWEL, green

THN6401A

Trunked Remote Control Housing Parts List

Motorola No. 3PL-SP5290317-1

11/4/85

PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R500	YLN4341B	EPROM 32k x 8; programming required includes:
	6-124C59	Resistor; 2.7k \pm 10%; 1/4 W
	15-80158C01	Cover
	54-80072G01	Label
	54-82614P92	Label, copyright

NOTE: R500 located on HLN4920A Trunked
Personality Board.

PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		MECHANICAL PARTS:
	2-2863	NUT, 5/16-18 x 9/16 x 7/32"; 5 used
	3-139269	SCREW, machine 5/16-18 x 1/2"; 5 used
	4-120839	LOCKWASHER, 5/16" external; 5 used
	7-80173B01	GUIDE, rail; 2 used
	7-80208G01	FORM, mounting
	64-83670M01	PLATE, radio mounting
	75-80195G01	PAD, tray; 2 used

HLN4667A

Mounting Tray Parts List

Motorola No. 7PL-SP5290170-1

11/2/84

PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	6-682977K03 6-684690C01	<u>MECHANICAL PARTS:</u> TOOL, tuning TOOL, contact removal

TRN4513A
 Tuning Tool Parts List
 Motorola No. 9PL-SP5290170-1
 11/2/84

DC POWER SUPPLY

MODEL TPN1197A

FUNCTION

Provides operating power for the base station.

TPN1197A Power Supply Model Complement

Model	Description
TPN6147A	Regulator Circuit Board Kit
TRN5497A	Heat Sink Kit
TRN5498A	Chassis & Hardware Kit

LS
ESIDES

ORG	TO Q5 & Q6 COLLECTORS
YEL-RED	TO Q5 & Q6 BASES
YEL	TO Q6 EMITTER
VIO	TO R13, R14 JUNCTION

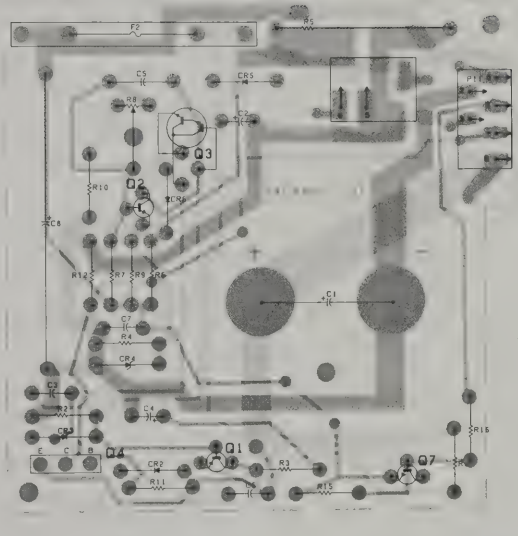
POWER SUPPLY

parts list

TPN6147A Regulator Board			PL-6417-O
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
C2	23-84665F03	capacitor, fixed, 100 uF ± 100-10%, 25 V	
C3	21-82428B10	.0033 uF ± 10%; 100 V	
C4	23-84665F06	220 uF ± 150-10%; 25 V	
C5	8-82065C02	.022 uF ± 10%; 50 V	
C6	21-82428B10	.0033 uF ± 10%; 100 V	
C7	21-82372C04	.05 uF ± 80-20%; 25 V	
C8	23-83210A18	500 uF ± 100-10%; 20 V	
CR2, 3	48-83654H01	diode (see note)	
CR4	48-82256C47	Zener, type: 5.6 V	
CR5, 6	48-83654H01	silicon	
Q1	48-889649	transistor (see note)	
Q2	48-889646	NPN; type M9649	
Q3	48-82022N06	NPN; Darlington M2206	
Q7	48-889642	NPN; type M9642	
R1	6-11009C21	resistor, fixed, ± 5%; 1/4 W unless otherwise stated	
R2	6-11009C73	10k	
R3	6-11009C33	220	
R4	6-10621B52	365 ± 1%; 1/8 W	
R5	17-82177B08	200 ± 10%; 5 W	
R6	6-11009C13	33	
R7	6-11009C49	1k	
R8	18-84944C01	variable; 2 k	
R9	6-11009C47	820	
R10	6-11009C39	380	
R11	6-11009C49	1k	
R12	6-11009C73	10k	
R13	6-10621A56	37.4 ± 1%; 1/8 W	
R16	6-10621A80	41.2 ± 1%; 1/8 W	
mechanical parts			
15-84927L01	HOUSING, receptacle; transistor		
42-82654G04	CLIP, fuse, 2 used		
29-84547B04	PN, contact 9 used		
mechanical parts			
2-119913	NUT, 6-32 x 11/32 x 1/8"; 4 used		
3-5963	SCREW, machine 10-32 x 3/8"		
3-139776	SCREW, tapping, 5-20 x 3/8"; 4 used		
3-10903A07	SCREW, machine M3 x 0.5 x 8		
4-115362	WASHER, lock #10 external		
14-84266A01	INSULATOR, transistor		
22-10133A17	PIN, 7/16 x 0.125"; 2 used		
42-84784B01	RETAINER, 4 used		
42-84929L01	"O" RING, retainer		
54-83561L01	LABEL, line cord		
1-80762D44	ASSEMBLY CHASSIS, eyeleted		

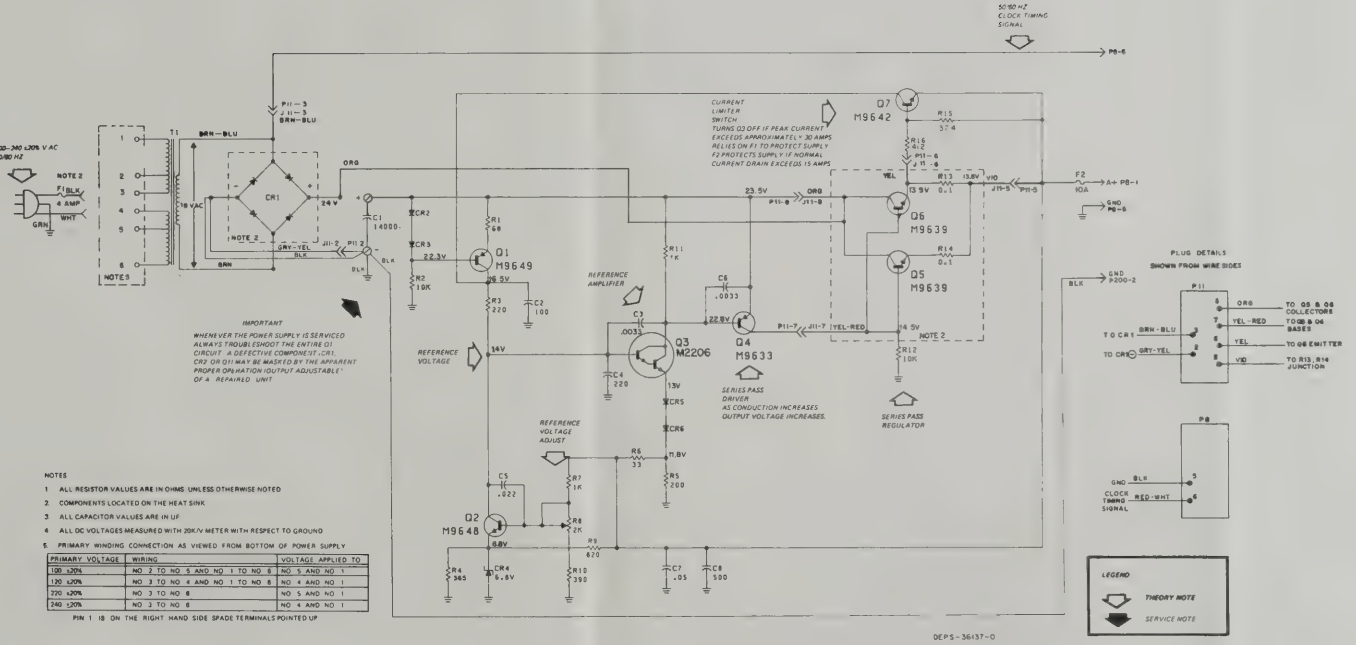
TRN5497A Heat Sink Kit			PL-6419-O
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION	
CR1	48-82018N01 or 48-82918N02	diode (see note)	
F1	65-61688	fuse	
Q5, 6	48-889639	transistor (see note)	
R13	17-84561G04	resistor, fixed, 0.1 ± 3%; 8 W	
R14	17-82177B50	0.1 ± 10%; 7 W	
mechanical parts			
3-135106	SCREW, machine: 6-32 x 15/16"; 4 used		
3-10803A07	SCREW, machine: M3 x 0.5 x 6; 3 used		
3-10904A12	SCREW, machine: M3 x 0.5 x 18		
3-83436L01	SCREW, machine: M3 x 0.5 x 35; 2 used		
4-1719	WASHER, flat: 0.141 x 0.375 x 0.30		
7-84926L01	BRACKET, line cord		
9-82063C03	RECEPTACLE, fuse		
9-82377H01	SOCKET, transistor; 2 used		
14-857437	INSULATOR, transistor; 2 used		
28-84843L02	heat sink		
29-8246	lug		
31-131751	terminal, strap		
37-20362	sleeving, rubber; 2 used		
42-10128A18	"O" RING, retainer; 2 used		
54-82599N01	LABEL, caution		
1-80762D39	LINE CORD AND PLUG, includes:		
29-10134A01	LUG, terminal; 2 used		
30-83211C12	CABLE, power supply and heat sink, includes:		
1-80762D40	RECEPTACLE, 6 used		
9-84151B03	INSULATOR		
14-84849L01	LUG, terminal; 2 used		
29-10134A01	STRAP, size: .091 x 3.82; 4 used		
1-80762D42	WIRE & LUG ASSEMBLY, includes:		
29-847653	LUG, crimp terminal		
29-859665	LUG, ring tongue		

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.



COMPONENT SIDE
SOLDER SIDE

SHOWN FROM SOLDER SIDE



DC POWER SUPPLY
MODEL TPN1197A

FUNCTION

Provides operating power for the base station.

TPN1197A Power Supply Model Complement

Model	Description
TPN6147A	Regulator Circuit Board Kit
TRN5497A	Heat Sink Kit
TRN5498A	Chassis & Hardware Kit



MOTOROLA INC.

Communications
Sector

SAFE HANDLING OF CMOS INTEGRATED CIRCUIT DEVICES

Many of the integrated circuit devices used in communications equipment are of the CMOS (Complementary Metal Oxide Semiconductor) type. Because of their high open circuit impedance, CMOS ICs are vulnerable to damage from static charges. Care must be taken in handling, shipping, and servicing them and the assemblies in which they are used.

Even though protection devices are provided in CMOS IC inputs, the protection is effective only against overvoltage in the hundreds of volts range such as are encountered in an operating system. In a system, circuit elements distribute static charges and load the CMOS circuits, decreasing the chance of damage. *However, CMOS circuits can be damaged by improper handling of the modules even in a system.*

To avoid damage to circuits, observe the following handling, shipping, and servicing precautions.

1. Prior to and while servicing a circuit module, particularly after moving within the service area, momentarily touch *both* hands to a bare metal earth grounded surface. This will discharge any static charge which may have accumulated on the person doing the servicing.

NOTE

Wearing Conductive Wrist Strap (Motorola No. RSX-4015A) will minimize static buildup during servicing.

WARNING

When wearing Conductive Wrist Strap, be careful near sources of high voltage. The good ground provided by the wrist strap will also increase the danger of lethal shock from accidentally touching high voltage sources.

2. Whenever possible, avoid touching any electrically conductive parts of the circuit module with your hands.

3. Normally, circuit modules can be inserted or removed with power applied to the unit. However, check the INSTALLATION and MAINTENANCE sections of the manual as well as the module schematic diagram to insure there are no objections to this practice.

4. When servicing a circuit module, avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) because they contribute to static buildup.

5. All electrically powered test equipment should be grounded. *Apply the ground lead* from the test equipment to the circuit module *before* connecting the *test probe*. Similarly, *disconnect the test probe prior* to removing the *ground lead*.

6. If a circuit module is removed from the system, it is desirable to lay it on a conductive surface (such as a sheet of aluminum foil) which is connected to ground through 100k of resistance.

WARNING

If the aluminum foil is connected directly to ground, be cautious of possible electrical shock from contacting the foil at the same time as other electrical circuits.

7. When soldering, be sure the soldering iron is grounded.

8. Prior to connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary in the replacement of an integrated circuit device), be sure to discharge any static buildup as described in procedure 1. Since voltage differences can exist across the human body, it is recommended that only one hand be used if it is necessary to touch pins on the CMOS device and associated board wiring.

9. When replacing a CMOS integrated circuit device, leave the device in its metal rail container or conductive foam until it is to be inserted into the printed circuit module.

10. All low impedance test equipment (such as pulse generators, etc.) should be connected to CMOS

device inputs after power is applied to the CMOS circuitry. Similarly, such low impedance equipment should be disconnected before power is turned off.

11. Replacement modules shipped separately from the factory will be packaged in a conductive material. Any modules being transported from one area to another should be wrapped in a similar material (aluminum foil may be used). NEVER USE NON-CONDUCTIVE MATERIAL for packaging these modules.



1. GENERAL INFORMATION

Instruction section W10001S93 (p/o instruction manual 68P81066E80) applies to the servicing of the L35VLB5174BMSP06 Advanced Trunked SYNTOR X™ FM Two-Way Control Station with the following exceptions.

- A final power amplifier (FPA) does not exist in the "SP06" control station because the required output power for this control station is from 3 to 10 watts. Disregard any reference to the FPA as shown on diagram PW-3291 (part of instruction section W10001S93).
- Disregard any reference to a control head and control head cable kit shown on diagram PW-3291.
- Use the radio chassis removal and installation information presented in this instruction section only.
- Use the transmitter power and audio power out adjustment procedures presented in this instruction section only.

2. RADIO CHASSIS REMOVAL AND INSTALLATION

It is assumed the control station is unplugged and the outside case is removed.

2.1 RADIO REMOVAL FROM MOUNTING TRAY

To remove the radio:

Step 1. Insert the key in the radio and turn. The radio handle should drop down, releasing the radio from its tray.

technical writing services

1301 E. Algonquin Road, Schaumburg, IL 60196

Step 2. If the radio is to be completely removed, unscrew the front cable connector P001 and the front antenna connector. If the radio is to be left connected for servicing, do not remove these connectors.

Step 3. Gently pull the radio forward. It may be necessary to angle the handle upward to obtain enough room to clear the rear spring tabs on the mounting tray.

Step 4. The radio can now be lifted out if all cables are disconnected. If the radio is to be serviced, the cables allow it to be placed next to the control station chassis on its top.

2.2 RADIO AND MOUNTING TRAY REMOVAL

To remove the radio and mounting tray for access to the control board:

Step 1. If the radio is to be completely removed, disconnect the front radio connector P001 and the antenna connector.

Step 2. Remove the two #10 screws that hold the mounting plate to the chassis. These screws are located on the left side of the chassis.

Step 3. Slide the radio and mounting tray assembly to the left until the mounting tray tab clears the alignment slot on the chassis. It can now be lifted clear and if the cables are still attached, it can be laid on its top next to the control station chassis. When lifting the radio with cables attached, be sure that they are clear of all front panel obstructions.

CAUTION

Do not attempt to carry both the radio and mounting tray together using the radio handle. When the handle is extended, the mounting tray is no longer captivated to the radio and will slide off.

2.3 RADIO AND MOUNTING TRAY REASSEMBLY

To reattach the radio/mounting tray assembly:

Step 1. Place the radio and tray on the chassis slightly to the rear from where it should mount. The right side of the radio should butt against the power supply.

Step 2. Push the radio and tray forward, keeping it butted against the power supply until forward motion is stopped by the mounting flange hitting the rear wall of the chassis.

Step 3. Slide radio and tray to the left, away from the power supply until the assembly drops into the alignment slot along the inside chassis wall.

Step 4. Push radio back toward the power supply and fasten mounting tray with two #10 screws on the left wall of the chassis.

NOTE

Failure to correctly mate the mounting tray with the chassis alignment slot will result in improper mounting and possible scratches on the radio cover when the outside shroud is put on.

2.4 RADIO REASSEMBLY TO MOUNTING TRAY

To reattach radio to mounting tray:

It is assumed that the mounting tray is already installed on the control station chassis.

Step 1. Place the radio on the mounting tray and slide backwards until the rear spring tabs of the tray engage the radio. If the radio is being held by the handle, angle the handle upward.

Step 2. Some pressure may be required to slide the radio back. Leaving the handle in the open position, place one hand on the radio front in the handle area and the other hand on the back of the tray. By applying pressure, the radio will slide back and compress the spring clips.

Step 3. Making sure that mounting tray tabs stick through the two slots in the radio, lock the radio handle in place. It should engage the mounting tabs for secure mounting of the radio.

3. TRANSMITTER POWER ADJUSTMENT

Step 1. Terminate the radio with a wattmeter and 50-ohm load.

NOTE

Refer to the List of Recommended Test Equipment provided in section W10001S93. It is recommended that only the recommended equipment be used in these adjustments to avoid erroneous results.

Step 2. Adjust the dc power supply voltage to 13.6 V.

NOTE

Since the transmitter employs a broadband power amplifier, any channel may be selected for the power adjustment procedure.

Step 3. Place radio in the test mode as described in section 2.2.2 of section W10001S93.

Step 4. Key up the transmitter and observe the output power indication. If the output power is greater than 5 W, go to Step 5; if the output power is less than 5 W, go to Step 6.

Step 5. Adjust the POWER SET potentiometer (Figure 1 of section W10001S93) for an output power indication of 10 W. A clockwise adjustment of this potentiometer (as viewed from the top of the radio) increases the output power, whereas a counterclockwise adjustment decreases the output power. If the initial output power is significantly greater than 10 W, it may suddenly drop during the course of this adjustment. If this condition occurs, go to Step 5.

Step 6. If the output power is less than 5 W, it is possible that the high drive protection circuit of the power control has been activated. Adjust the POWER SET potentiometer (Figure 1 of section W10001S93) in a counterclockwise direction until the output power drops to approximately 2 W. Rekey the transmitter and adjust the POWER SET potentiometer until an indication of 10 W is obtained.

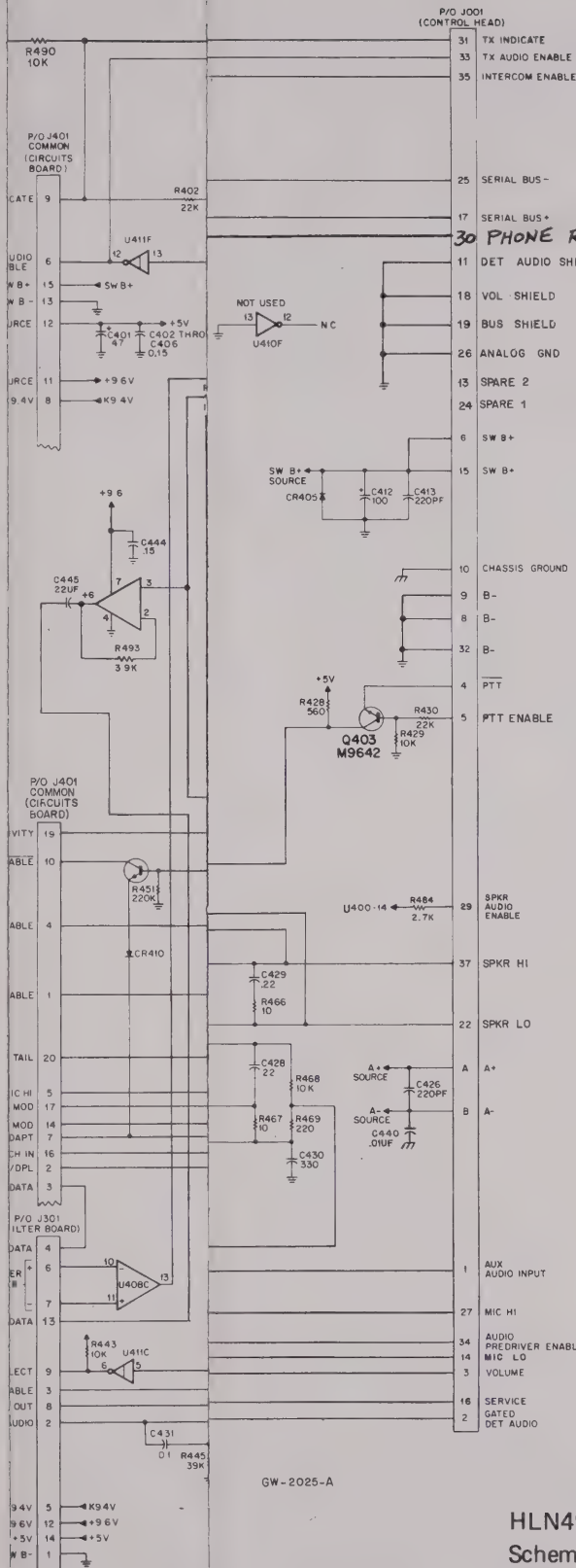
4. AUDIO POWER OUT ADJUSTMENT

Step 1. Put the radio in the service mode as described in section 2.2.2 of section W10001S93.

Step 2. Apply a 1000 uV signal of the proper frequency to the antenna connector. Make sure that the radio does not transmit at any time during this procedure. Modulate the signal with a 1 kHz sine wave at 3 kHz deviation.

Step 3. Connect an ACVM between TB2-3 and TB1-7 (GND). Make sure all external audio loads are disconnected from the trunked control station.

Step 4. Adjust the line level pot (R504) that is mounted in back of front panel for 6.0 V rms on the ACVM.



NUMBER	DESCRIPTION	V _{CC} +5V	GND	V _{EE} +9.6V
U400	MICROPROCESSOR	21	1	
U401	8K x 8 EPROM	28	14	
U402	2K x 8 RAM	24	12	
U405	8823 PIA	40	20	
U406	82C45 PIA	20	10	
U407	1 OF 8 DECODER	16	8	
U408	QUAD OPERATIONAL AMPLIFIER	12	3	
U410	HEX INVERTER	14	7	
U411	HEX INVERTER (OPEN COLLECTOR)	14	7	
U412	CLASS B AUDIO DRIVER	8	3	
U413	OPERATIONAL AMPLIFIER	8	7	

NOTES

- UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS, AND CAPACITOR VALUES ARE IN MICROFARADS.
- SELF-TEST PADS ARE FOR TRUNKING TEST MODES.
- THE TRANSISTORS Q409/Q412 ARE MATCHED-PAIR TRANSISTORS AND SHOULD BE REPLACED AS SUCH IF FOUND INOPERATIVE.
- ALL JUMPERS APPEAR AS STANDUP RESISTORS.
- CR403 AND CR404 ARE FOR MICROPROCESSOR MODE SELECTION. (MULTIPLIED MODEL).
- FOR 8K x 16K x 8 DEVICES, JU402 IS IN AND JU403 IS OUT. FOR 32K x 8 DEVICES, JU402 IS OUT AND JU403 IS IN.
- J901 IS A 25-PIN IN-LINE CONNECTOR USED FOR A 2K x 8 EPROM CODE PLUG MODULE OPTION. A 27-PIN IN-LINE CONNECTOR IS USED FOR 8K x 8 EPROM CODE PLUG MODULE OPTION.

**B. R500 PART OF YLN4341B
EPROM KIT,**

GW-2025-A

HLN4920A Advanced Trunked Personality Board
Schematic Diagram and Parts List
Motorola No. 14-SP5290317-1
5/16/88

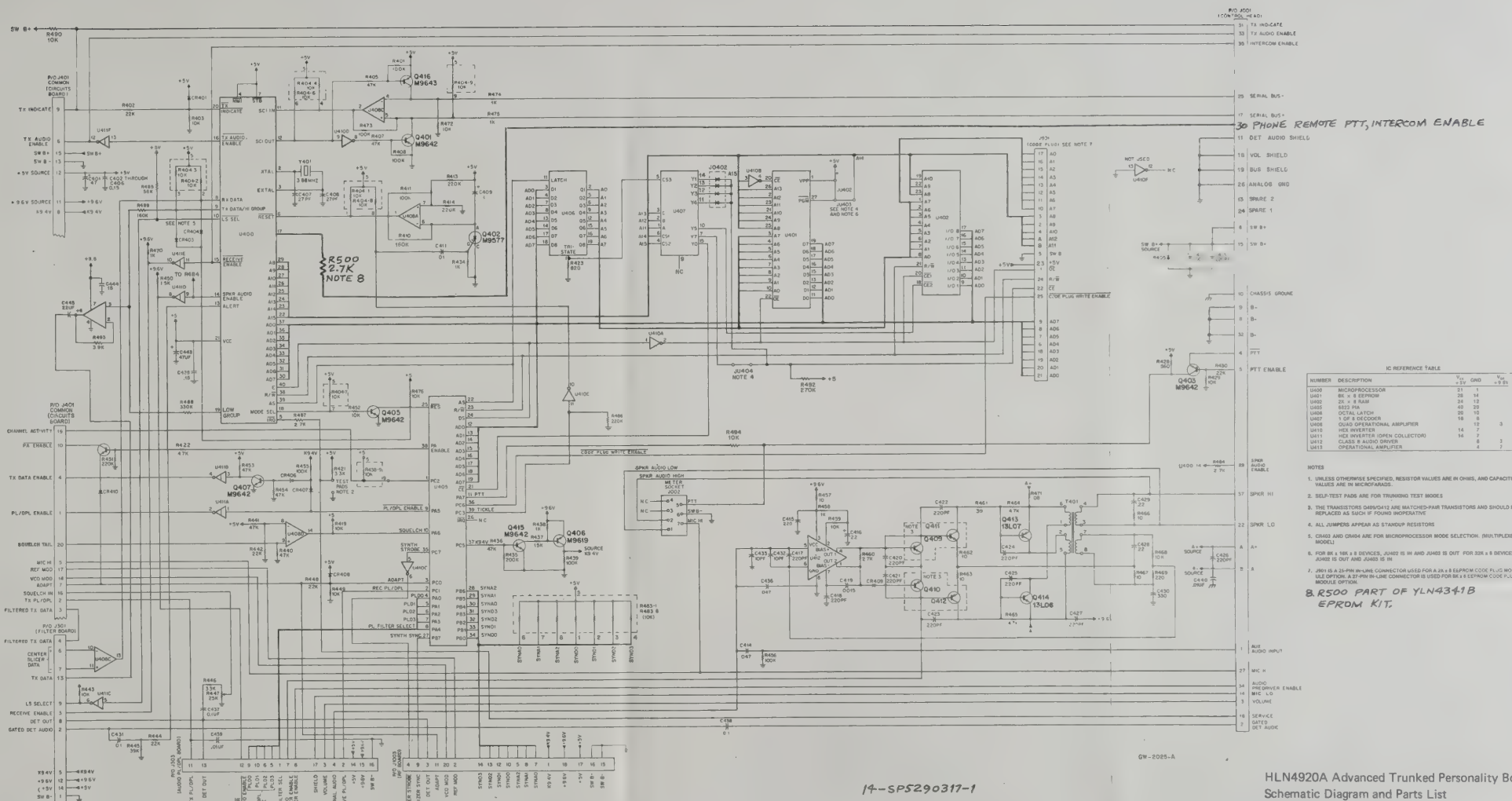
parts list

HLN4920A SYNTOR X Trunked Personality Board MXW-2025-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C401	23-84538G29	capacitor, fixed, pF ±5%, 50V unless otherwise stated
C402, 408	21-84008H21	47 ±20%, 10V, tantalum
C409	21-11014H35	27 pF, 100V
C411	23-11013D51	1 ±20%, 20V, tantalum
C412	21-11015A07	1 μF ±80, -20%, 100V
C413	23-8321A0A8	100 ±150, -10%, 25V, electrolytic
C414	21-11015B05	220 ±20%, 10V, 100V
C415	08-11051A11	0.47, 63V
C416	23-82747L08	220 ±10%, 25V, electrolytic
C417	23-11013C08	22 ±20%, 15V, tantalum
C418, 417	21-11013B05	220 pF ±10%, 100V
C419	08-11051A02	.0015, 63V
C420-427	21-11015A06	220 pF ±10%, 100V
C428, 429	08-11051A15	22, 63V
C430	23-82747L01	330 ±100, -10%, 20V, electrolytic
C431	08-11051A11	1, 63V
C432, 433	21-82877B33	10 pF ±10%, 75V
C435	21-84008H21	15 ±20%
C436	08-11051A11	0.47, 63V
C437, 438	08-11051A13	1, 63V
C439, 440	21-84008H09	01 ±10%
C443	23-84538G29	47 ±20%, 10V, tantalum
C444	21-84008H21	15 ±20%
C445	23-11013C36	22 ±20%, 15V, tantalum
CR401	48-84816A11	diode (see note)
CR402, 404	48-84816A11	hot carrier
CR405	48-82525G02	silicon
CR406	48-83654H01	silicon
CR407, 408	48-84816A11	hot carrier
CR409	48-83654H01	silicon
CR410	48-84816A11	hot carrier
J2	09-84207B01	connector receptacle
J301	09-84924E05	7-contact
J303	09-84924E04	18-contact
J401	28-83623M02	20-contact header
J901	28-82622L15	25-contact
J1003	28-82647K02	10-contact, 2 used
Q401	48-00869642	transistor (see note)
Q402	48-00869577	PN junction, type M9677
Q403, 405	48-00869642	NPN, type M9642
Q406	48-00869619	PNP, type M9619
Q407, 408	48-00869642	NPN, type M9642
Q409A11	01-80737498	type M9648 (matched pair)
Q410A12	01-80737495	type M9648 (matched pair)
Q413	48-84413L07	PNP, type M1307
Q414	48-84413L08	NPN, type M1308
Q415	48-00869642	NPN, type M9642
Q416	48-00869643	PNP, type M9643
R401	06-11009E97	resistor, fixed, Ω ±5%, 1/4 W unless otherwise stated
R402	06-11009E81	22k
R403	06-11009E73	10k
R404	51-82142K15	resistor network
R405, 407	06-11009E89	47k
R408	06-11009E97	100k
R410	06-11009E93	150k
R411	06-11009E97	100k
R413, 414	06-11009F06	220k
R419	06-11009E73	10k
R421	06-11009E81	3.3k
R422	06-11009E89	47k
R423	06-11009E47	820
R428	06-11009E43	560
R429	06-11009E73	10k
R430	06-11009E81	22k
R434	06-11009E49	1k
R435	06-11009F06	220k
R436	06-11009E89	47k
R437	06-11009E53	1.5k
R438	06-11009E49	1k
R439	06-11009E97	100k
R440, 441	06-11009E89	47k
R442	06-11009E81	22k
R443	06-11009E73	10k
R444	06-11009E91	22k
R445	06-11009E87	39k
R446	06-11009E81	330k
R447	18-80087E01	25k, variable
R448	06-11009E81	22k
R449	06-11009E73	10k
R450	06-11009E53	1.5k
R451	06-11009F06	220k
R452	06-11009E73	10k
R453, 454	06-11009E89	47k
R455, 456	06-11009E97	100k
R457	06-11009E01	1k
R458	06-11009E49	1k
R459	06-11009E73	10k
R460	06-11009E59	2.7k
R461	06-11009E15	39
R462, 463	06-11009E01	10
R464, 465	06-11009E85	4.7k
R466, 467	06-11009E01	10
R468	06-11009E73	10k
R469	06-11009E33	220
R470	06-11009E49	1k
R471	17-82350A14	.08 ±20%, 1W
R472	06-11009E73	10k
R473	06-11009E97	100k
R474, 475	06-11009E49	1k
R476	06-11009E73	10k
R483	51-82142K15	resistor network
R484	06-11009E59	2.7k
R485	06-11009E91	56k
R486	06-11009F06	220k
R487	06-11009E59	2.7k
R488	06-11009F10	330k
R489	06-11009F03	150k
R490	06-11009E73	10k
R492	06-11009F08	270k
R493	06-11009E83	3.9k
R494	06-11009E73	10k
T401	25-84083B03	transformer audio output
U400	51-84944N17	integrated circuit (see note)
U402	51-83625M23	8-bit MPU
U405	51-83625M23	advance data link controller
U406	51-83810P04	parallel interface for MPU
U407	51-11991B03	HCMOS octal "D" flip-flop
U408	51-83629A09	comparator
U410	51-83810P02	HCMOS hex inverter
U411	51-84371K07	inverter hex buffers with drivers
U412	51-80095C02	audio driver
U413	51-80067C05	FET op amp
U1105	51-90043B01	EPROM 32Kx8
Y401	48-82611M23	crystal (see note)
	75-52526S01	3.688 MHz crystal

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R436	06-11009E89	47k
R437	06-11009E53	1.5k
R438	06-11009E49	1k
R439	06-11009E97	100k
R440, 441	06-11009E89	47k
R442	06-11009E81	22k
R443	06-11009E73	10k
R444	06-11009E91	22k
R445	06-11009E87	39k
R446	06-11009E81	330k
R447	18-80087E01	25k, variable
R448	06-11009E81	22k
R449	06-11009E73	10k
R450	06-11009E53	1.5k
R451	06-11009F06	220k
R452	06-11009E73	10k
R453, 454	06-11009E89	47k
R455, 456	06-11009E97	100k
R457	06-11009E01	1k
R458	06-11009E49	1k
R459	06-11009E73	10k
R460	06-11009E59	2.7k
R461	06-11009E15	39
R462, 463	06-11009E01	10
R464, 465	06-11009E85	4.7k
R466, 467	06-11009E01	10
R468	06-11009E73	10k
R469	06-11009E33	220
R470	06-11009E49	1k
R471	17-82350A14	.08 ±20%, 1W
R472	06-11009E73	10k
R473	06-11009E97	100k
R474, 475	06-11009E49	1k
R476	06-11009E73	10k
R483	51-82142K15	resistor network
R484	06-11009E59	2.7k
R485	06-11009E91	56k
R486	06-11009F06	220k
R487	06-11009E59	2.7k
R488	06-11009F10	330k
R489	06-11009F03	150k
R490	06-11009E73	10k
R492	06-11009F08	270k
R493	06-11009E83	3.9k
R494	06-11009E73	10k
T401	25-84083B03	transformer audio output
U400	51-84944N17	integrated circuit (see note)
U402	51-83625M23	8-bit MPU
U405	51-83625M23	advance data link controller
U406	51-83810P04	parallel interface for MPU
U407	51-11991B03	HCMOS octal "D" flip-flop
U408	51-83629A09	comparator
U410	51-83810P02	HCMOS hex inverter
U411	51-84371K07	inverter hex buffers with drivers
U412	51-80095C02	audio driver
U413	51-80067C05	FET op amp
U1105	51-90043B01	EPROM 32Kx8
Y401	48-82611M23	crystal (see note)
	75-52526S01	3.688 MHz crystal

note: For best performance, order diodes, transistors, and integrated circuits by Motorola part number.



14-SP5290317-1

HLN4920A Advanced Trunked Personality Board
Schematic Diagram and Parts List
Motorola No. 14-SP5290317-1
5/16/88



1. THEORY OF OPERATION

1.1 Microstrip design employing ceramic substrate boards has been used in the Trunked SYNTOR X Control Station transmitter. All the transmitter stages consist of 50-ohm blocks with class-C amplifier circuitry. The transmitter comprises two major sections: the intermediate power amplifier (IPA) and the power amplifier (PA).

1.2 The rf output generated by the frequency synthesizer at the required transmit carrier frequency is applied to the controlled stage of the IPA (Q700). The gain of the controlled stage and the output power of the radio can be changed by varying the control voltage. The IPA output stage (Q701) is driven by the controlled stage. DC power for the IPA output stage is supplied via the output coaxial cable. The IPA module has a rated output power of 1.2 W.

1.3 The rf signal passes from the IPA to the final power amplifier via a coaxial cable and is then applied to the predriver stage (Q750), which is followed by the driver stage (Q800). The predriver and driver stages, which are mounted on separate microstrip assemblies, can provide 4.5 W and 18 W outputs, respectively.

1.4 The rf power output from the driver module is applied to a directional coupler. The directional coupler is used to measure both the forward and reflected power. Information related to the forward and reflected power is relayed to the power control circuitry located on the common circuit board. The power control circuits react to any change in power by causing a change in the rf drive in such a direction as would restore the rf power output to its original level.

1.5 When the VSWR (voltage standing wave ratio) at the radio output connector reaches a level that can damage the final power transistors, the power control circuitry reacts by reducing the rf power output to a predetermined safe level (2 W to 4 W). The directional coupler rf output is routed to the antenna via a harmonic filter and the antenna relay. The rf output power at the directional coupler is variable from 3 to 10 watts.

1.6 The transmitter is provided with a metering socket (J1101) that facilitates the following measurements:

- J1101-1 and J1102 (pins 1 and 2 of the metering socket) permit checking of the directional coupler outputs. J1101-1 provides a dc voltage proportional to the forward power level, and J1101-2 provides a dc voltage proportional to the reflected power level.
- In the transmitter, rf detectors are located at the input of each stage. All of the rf detectors are used in conjunction with metering socket pin 3 (J1101-3). When the rf input to any stage is to be measured, a jumper is used to connect J1101-3 to the rf detector of the stage being checked.
- J1101-4 is used to measure the transmitter supply voltage.

2. POWER AMPLIFIER TROUBLESHOOTING PROCEDURE

2.1 PREREQUISITE TEST SET-UP

NOTE

Refer to the list of Recommended Test Equipment provided in the Maintenance Section of this instruction manual.

Step 1. Connect the radio antenna connector to a wattmeter terminated in a 50-watt dummy load. Be sure that the wattmeter, load, and interconnect cable are rated for use at 800 MHz.

Step 2. Connect the radio to a 13.6-volt dc power supply capable of supplying at least the maximum transmit current specified for your radio.

Step 3. Using a TEK-37 Test Set Adapter, connect a Motorola S1056 Portable Test Set to the radio as follows:

- Connect the 20-pin connector of the test set adapter to the receptacle on the front panel of the portable test set.

- Connect the white “metering” plug of the test set adapter to the power amplifier metering receptacle.

Step 4. Set the portable test set switches as follows:

- Set the FUNCTION switch to the XMTR position.
- Set the METER switch to the REV. position.
- Set the test set adapter REF. switch to position A.
- Set the test set adapter 1V-100 mV switch to the 100 mV position. (If the test set adapter is not provided with such a switch, the unit operates at 100 mV at all times.)

Step 5. Before operating any equipment, refer to the CAUTION provided on the power amplifier troubleshooting chart (DEPS-30646) and make sure that all ac-operated test equipment units are isolated from the ac line ground.

Step 6. Because of power control shutback function, the power amplifier output power may range between 2 W and 4 W. Refer to the power amplifier power setting procedure to determine whether or not shutback is occurring.

2.2 INTERPRETATION OF DATA PROVIDED IN POWER OUTPUT TABLE.

2.2.1 Refer to the power output table shown in the troubleshooting chart. This table provides typical (not absolute) meter readings along with power control voltages and total current levels for different power outputs. This table can be used to determine when the performance of a power amplifier module has deteriorated below accepted levels. This can be done as follows:

1. Turn the power control potentiometer (R980) fully clockwise.
2. Set the power output to a low level.
3. Take the various meter readings required and compare them with those provided in the table. For a 5-watt power output for example, the table provides the following:

POWER CONTROL VOLTAGE:	2.44 V
TOTAL RADIO CURRENT:	3.7A
MS1:	4.0 uA
MS2:	0 uA
IPA1/MS3:	27 uA
IPA2/MS3:	11 uA
PREDRIVER/MS3:	9 uA
DRIVER/MS3:	11 uA

NOTE

The readings obtained from a degraded module will be lower than the typical readings provided by the table.

2.2.2 When the gain of a power amplifier module stage degrades, the power control circuit will attempt to increase the power level; this results in providing more drive power to the modules preceding the faulty stage.

2.2.3 It will be noted from the table that MS3 (Pin #3 of the PA metering socket) is associated with IPA1, IPA2, PD and DR (refer to the abbreviations provided on the troubleshooting chart).

2.3 TROUBLESHOOTING PROCEDURE

Step 1. Refer to the symbols and abbreviations provided on the power amplifier troubleshooting chart, as well as to the CAUTION and typical meter readings table contained on the diagram.

Step 2. Follow the step-by-step procedure outlined on the troubleshooting chart.

3. RF POWER CONTROL TROUBLESHOOTING PROCEDURE

The rf power control troubleshooting procedure consists (as shown in the associated troubleshooting charts) of:

- insufficient power output
- lack of power control
- VSWR protection
- high-drive protection

NOTE

All voltage measurements are referenced to A-.

3.1 INSUFFICIENT POWER OUTPUT

Step 1. Perform the steps specified in the insufficient power output section of the RF Power Control Troubleshooting Chart (EEPS-30647).

Step 2. After locating and correcting the fault, it is highly recommended that the following procedures be performed:

- VSWR protection
- high-drive protection

3.2 LACK OF POWER CONTROL

If there is sufficient power output but it is impossible to adjust the power control, proceed as follows:

Step 1. Perform the steps specified in the lack of power control troubleshooting chart (EEPS-30647).

Step 2. After locating and correcting the fault, it is highly recommended that the following two procedures be performed:

- VSWR protection
- high-drive protection

NOTE

When the power amplifier fails, it is very probable that the power control protection functions are not operating properly. Consequently, it is recommended that the following two procedures be performed. These procedures (as explained above) should also be performed after completing the insufficient power output procedure or the lack of power control procedure.

3.3 VSWR PROTECTION TEST

Step 1. Use the standard test set-up outlined in the paragraph dealing with the power amplifier troubleshooting procedure.

Step 2. Verify that the radio is terminated in a 50-ohm load as explained in the test set-up.

Step 3. Briefly key the transmitter and adjust the POWER SET potentiometer (R980) until a power output indication of $10\text{ W} \pm 1.5\text{ W}$ is obtained on all channels.

NOTE

Avoid extended keying of the transmitter as explained previously.

Step 4. Remove the 50-ohm load from the radio. Briefly key the transmitter again and verify that an output power indication of approximately 2 W (one-sixth of the nominal output power) is obtained on all channels. Also verify that the voltage indication on U951-8 (i.e., pin 8 on U951) is greater than 7 V. If either or both indications are incorrect, refer to the VSWR protection troubleshooting chart and perform the steps outlined in this chart.

3.4 HIGH-DRIVE PROTECTION TEST

Step 1. Use the standard test set-up outlined in the paragraph dealing with the power amplifier troubleshooting procedure.

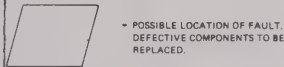
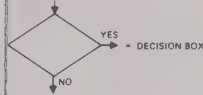
Step 2. Verify that the radio is terminated in a 50-ohm load. Set the power supply voltage to 13 V.

Step 3. With the transmitter dekeyed, disconnect plug J1. Key the transmitter and verify that the POWER SET voltage provides an indication of 1.1 V is obtained between 1 to 2.5 V is the nominal power set voltage. If the POWER SET voltage indication is incorrect, refer to the high-drive protection troubleshooting chart and perform the steps outlined in this chart.

NT POWER OUTPUT LEVELS

P.A. METERING SOCKET READINGS (IN MICROAMPS)					
MS1	MS2	IPA1/MS3	IPA2/MS3	PD/MS3	DR/MS3
10	0	27	11	18	11
15	0	36	11	17	17
20	0	37	12	17	25

LS AND ABBREVIATIONS USED
S FLOWCHART



P.O. POWER OUTPUT
P.A. POWER AMPLIFIER

PA INTERMEDIATE POWER AMPLIFIER
PA1 INTERMEDIATE POWER AMPLIFIER NO. 1
PA2 INTERMEDIATE POWER AMPLIFIER NO. 2
PD PREDRIVER
DR DRIVER
CB COMMON CIRCUIT BOARD
MS3 PIN NO. 3 OF THE METERING SOCKET

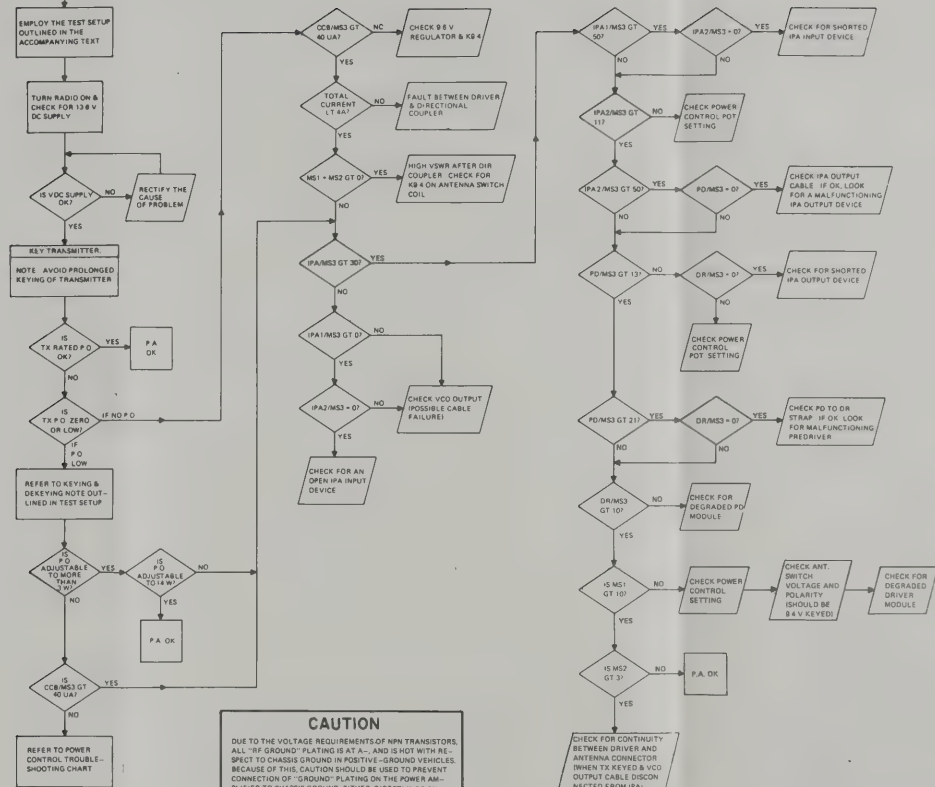
PA1/MS3 PIN NO. 3 OF METERING SOCKET ASSOCIATED WITH
INTERMEDIATE P.A. NO. 1. THE METERING SOCKET
IS LOCATED ON P.A. BOARD. OTHERS ARE IPA2/MS3,
FPA/MS3, PD/MS3, DR/MS3.

CB8/MS3 PIN NO. 3 OF METERING SOCKET LOCATED ON THE
COMMON CIRCUITS BOARD.

GT GREATER THAN. USED FOR COMPARISON.
GE GREATER THAN OR EQUAL. USED FOR COMPARISON.
LT LESS THAN. USED FOR COMPARISON.
LE LESS THAN OR EQUAL. USED FOR COMPARISON.

TRUNKED SYNTOR X TRANSMITTER

POWER AMPLIFIER TROUBLESHOOTING CHART



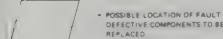
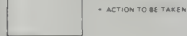
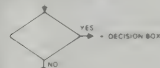
CAUTION

DUE TO THE VOLTAGE REQUIREMENTS OF NPN TRANSISTORS, ALL "RF GROUND" PLATING IS AT A-, AND IS NOT WITH RESPECT TO CHASSIS GROUND IN POSITIVE-GROUND VEHICLES. BECAUSE OF THIS, CAUTION SHOULD BE USED TO PREVENT CONNECTION OF "GROUND" PLATING ON THE POWER AMPLIFIER TO CHASSIS GROUND, EITHER DIRECTLY OR BY THE USE OF TEST EQUIPMENT GROUND LEADS. IF AC-OPERATED TEST EQUIPMENT IS USED, THE GROUND LEAD MUST NOT BE ELECTRICALLY CONNECTED TO AC-LINE GROUND.

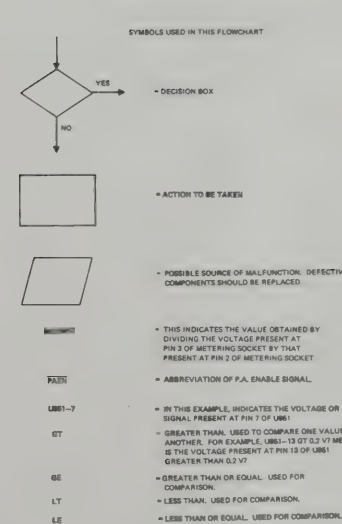
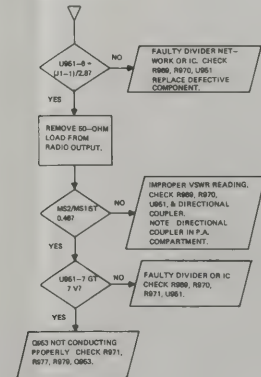
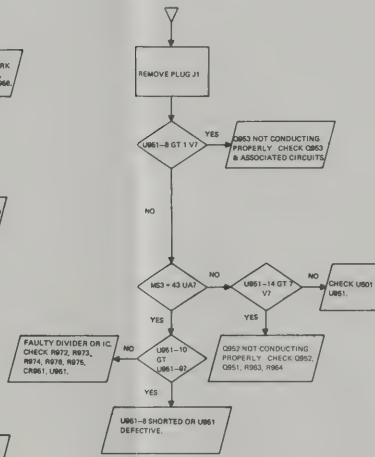
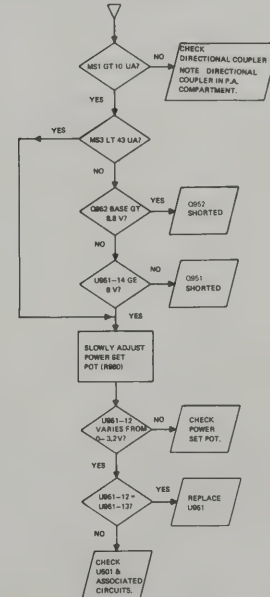
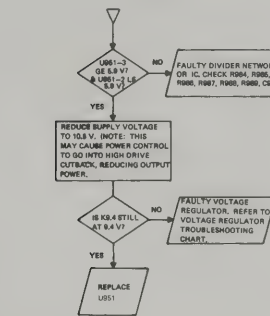
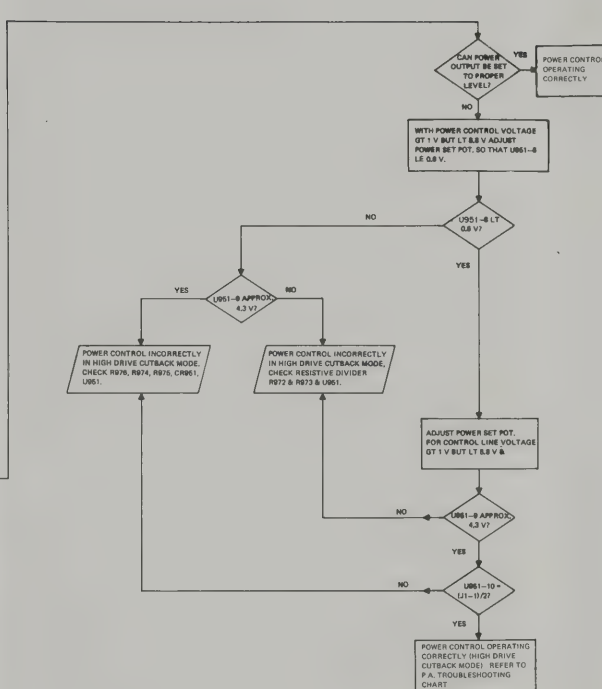
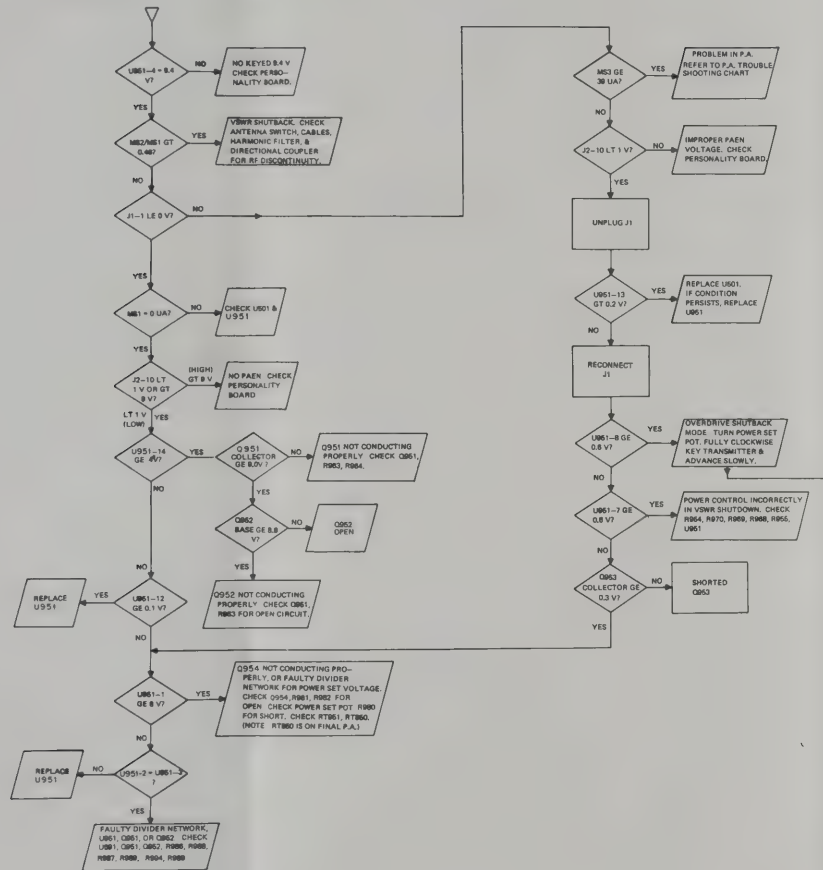
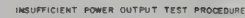
TYPICAL METER READINGS ASSOCIATED WITH DIFFERENT POWER OUTPUT LEVELS

POWER OUTPUT (WATTS)	POWER CONTROL VOLTAGES (V)	TOTAL RADIC CURRENT (A)	P.A. METERING SOCKET READINGS (IN MICROAMP)					
			MS1	MS2	PA1 MS3	PA2 MS3	PO MS2	OR MS3
5	2.44	2.7	0	0	21	11	16	11
10	2.95	5.0	0	0	36	11	17	15
15	2.81	8.2	0	0	31	12	17	24

SYMBOLS AND ABBREVIATIONS USED
IN THE FLOWCHART



PO	POWER OUTPUT
PA	POWER AMPLIFIER



CAUTION

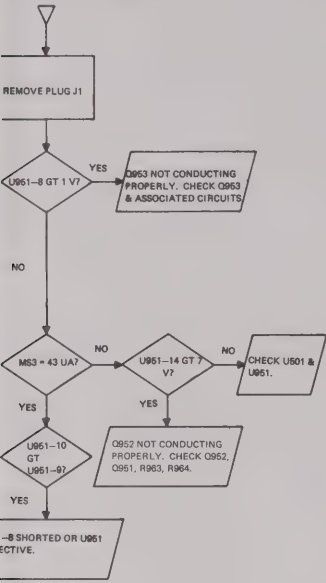
SINCE THE CRITICAL VOLTAGES IN THE POWER CONTROL EXIST ONLY DURING TRANSMIT CONDITIONS, THE TRANSMITTER SHOULD BE ONLY BRIEFLY KEVED FOR MAKING THE TEST AND TAKING MEASUREMENT. PROLONGED KEYING OF THE TRANSMITTER SHOULD BE AVOIDED SINCE SUCH KEYING WOULD PLACE THE POWER CONTROL INTO PROTECTIVE SHUTBACK, THUS CAUSING THE GENERATION OF ERRONEOUS AND CONFUSING SYMPTOMS.

NOTE

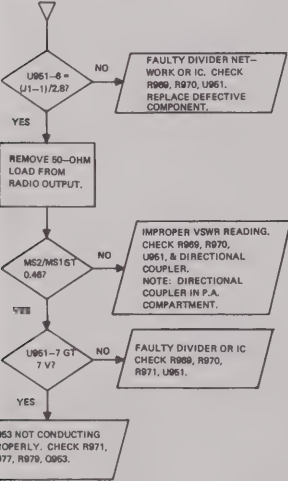
WHEN THE POWER AMPLIFIER FAILS, IT IS VERY PROBABLE THAT THE POWER CONTROL PROTECTION FUNCTIONS ARE NOT OPERATING PROPERLY. CONSEQUENTLY, IT IS RECOMMENDED THAT THE FOLLOWING THREE CHECKS ILLUSTRATED ON THIS FLOWCHART BE PERFORMED WHENEVER THE POWER AMPLIFIER FAILS: (A) VOWR PROTECTION; (B) HIGH-LINE PROTECTION; AND (C) HIGH-DRIVE PROTECTION. IT IS ALSO RECOMMENDED THAT THESE THREE CHECKS BE PERFORMED AFTER COMPLETING ANY OF THE TWO OTHER CHECKS (NAMESLY, HIGH-TEMPERATURE POWER OUTPUT AND LACK OF POWER CONTROL).

NOTE
ALL VOLTAGE VALUES ARE REFERENCED TO A—.

PROTECTION TEST PROCEDURE

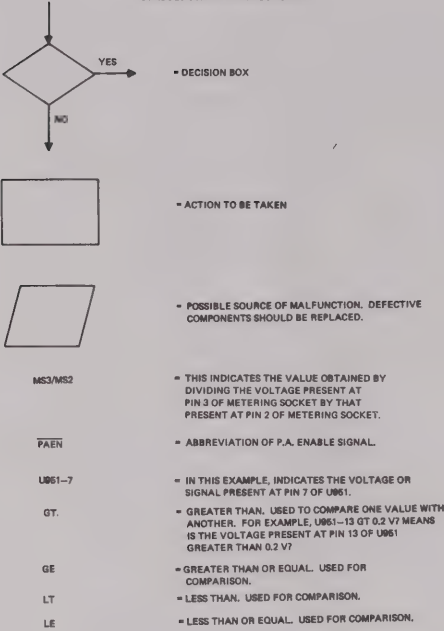


TECTION TEST PROCEDURE



SYNTRON X POWER CONTROL TROUBLESHOOTING CHART

SYMBOLS USED IN THIS FLOWCHART



CAUTION

SINCE THE CRITICAL VOLTAGES IN THE POWER CONTROL EXIST ONLY DURING TRANSMIT CONDITIONS, THE TRANSMITTER SHOULD BE ONLY BRIEFLY KEYED FOR MAKING THE TEST AND TAKING A MEASUREMENT. PROLONGED KEYING OF THE TRANSMITTER SHOULD BE AVOIDED SINCE SUCH KEYING WOULD PLACE THE POWER CONTROL INTO PROTECTIVE SHUTBACK, THUS CAUSING THE GENERATION OF ERRONEOUS AND CONFUSING SYMPTOMS.

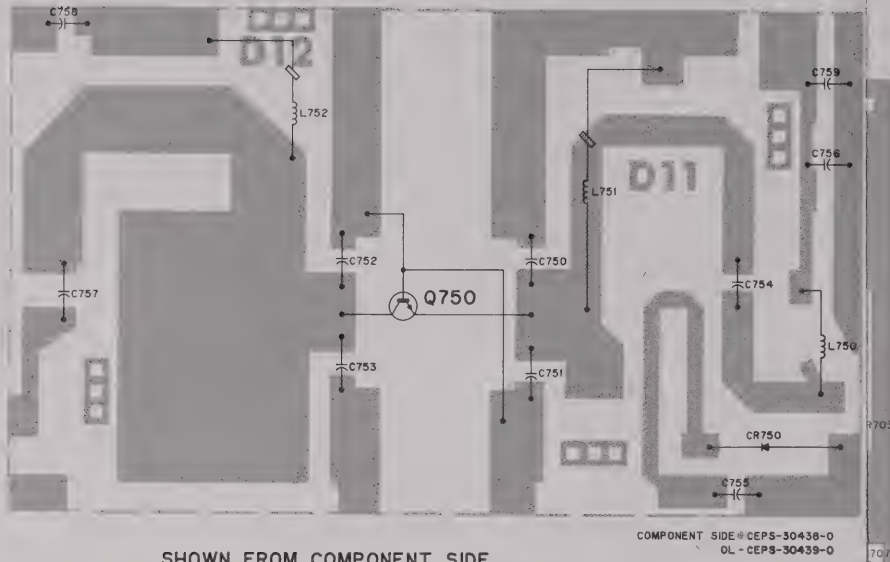
NOTE

WHEN THE POWER AMPLIFIER FAILS, IT IS VERY PROBABLE THAT THE POWER CONTROL PROTECTION FUNCTIONS ARE NOT OPERATING PROPERLY. CONSEQUENTLY IT IS RECOMMENDED THAT THE FOLLOWING THREE CHECKS (ILLUSTRATED ON THIS FLOWCHART) BE PERFORMED WHENEVER THE POWER AMPLIFIER FAILS: (A) VSWR PROTECTION, (B) HIGH-LINE PROTECTION, AND (C) HIGH-DRIVE PROTECTION. IT IS ALSO RECOMMENDED THAT THESE THREE CHECKS BE PERFORMED AFTER COMPLETING ANY OF THE TWO OTHER CHECKS (NAMELY, INSUFFICIENT POWER OUTPUT AND LACK OF POWER CONTROL).

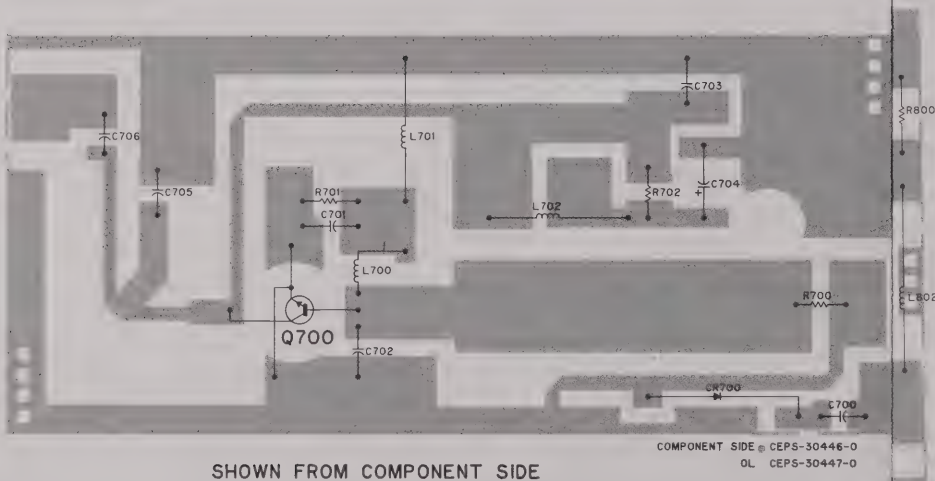
NOTE

ALL VOLTAGE VALUES ARE REFERENCED TO A-.

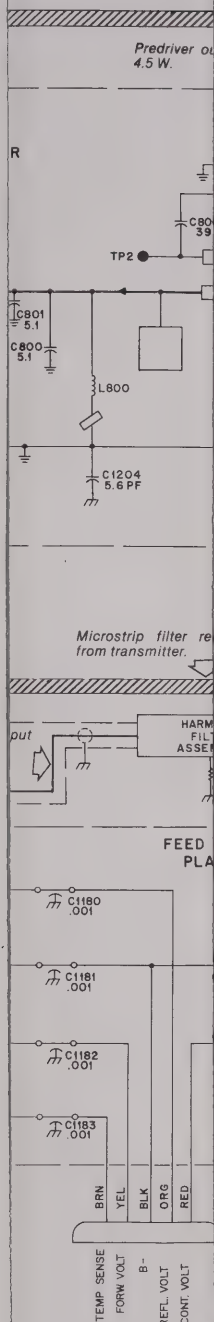
PREDRIVER



IPA INPUT



Power Amplifier Deck Schematic
Diagram and Substrates
Motorola No. PEPS-30782-B
(Sheet 1 of 2)
1/7/81-UP



Output power from IPA varies from 0 to greater than 1.2 W out depending upon the control voltage applied to the collector of Q700. Collector voltage for Q701 is supplied via the coaxial cable to the predriver.

NOTES:

1. Unless otherwise indicated: resistor values are in ohms; capacitor values are in microfarads; and inductor values are in nanohenries.
2. Meter 3 functions are determined by TP6 jumpering as shown in table.

Jumpering Table for Test Points

Connect	To	Testing
TP6	TP1	Driver
TP6	TP2	Predriver
TP6	TP3	IPA Output
TP6	TP4	IPA Input
TP6	TP5	Transmit Injection

Legend:

Area Capacitor	
Transmission Line	
Ferrite Bead	
Substrate Ground	
Chassis Ground	
Power Control Ground	

Power Amplifier Deck
Schematic Diagram and Substrates
Motorola No. PEPS-30782-B
(Sheet 2 of 2)

1/7/81-UP

COMPONENT SIDE - CEPS-30438-0
OL - CEPS-30439-0

Figure 1 is a schematic diagram of the experimental setup. It shows a subject seated at a table, looking at a video screen. A camera is positioned above the screen. A horizontal bar is placed on the table, with a vertical rod passing through its center. The rod is connected to a motor unit. The motor unit is connected to a power source. The video screen displays the visual feedback of the hand position.

COMPONENT SIDE © CEPS-30442-0
OL CEPS-30443-0

COMPONENT SIDE o CEPS-30444-0
OL CEPS 30445-0

COMPONENT SIDE @ CEPS-30446-0
DL CEPS-30447-0

COMPONENT SIDE @ CEP3-30448-0
OL CEP3-30449-0

COMPONENT SIDE © CEPS-30450-0
OL CEPS-30451-0

Field repair of this kit is not recommended. It should be replaced in its entirety. The following parts are listed for reference purposes only.

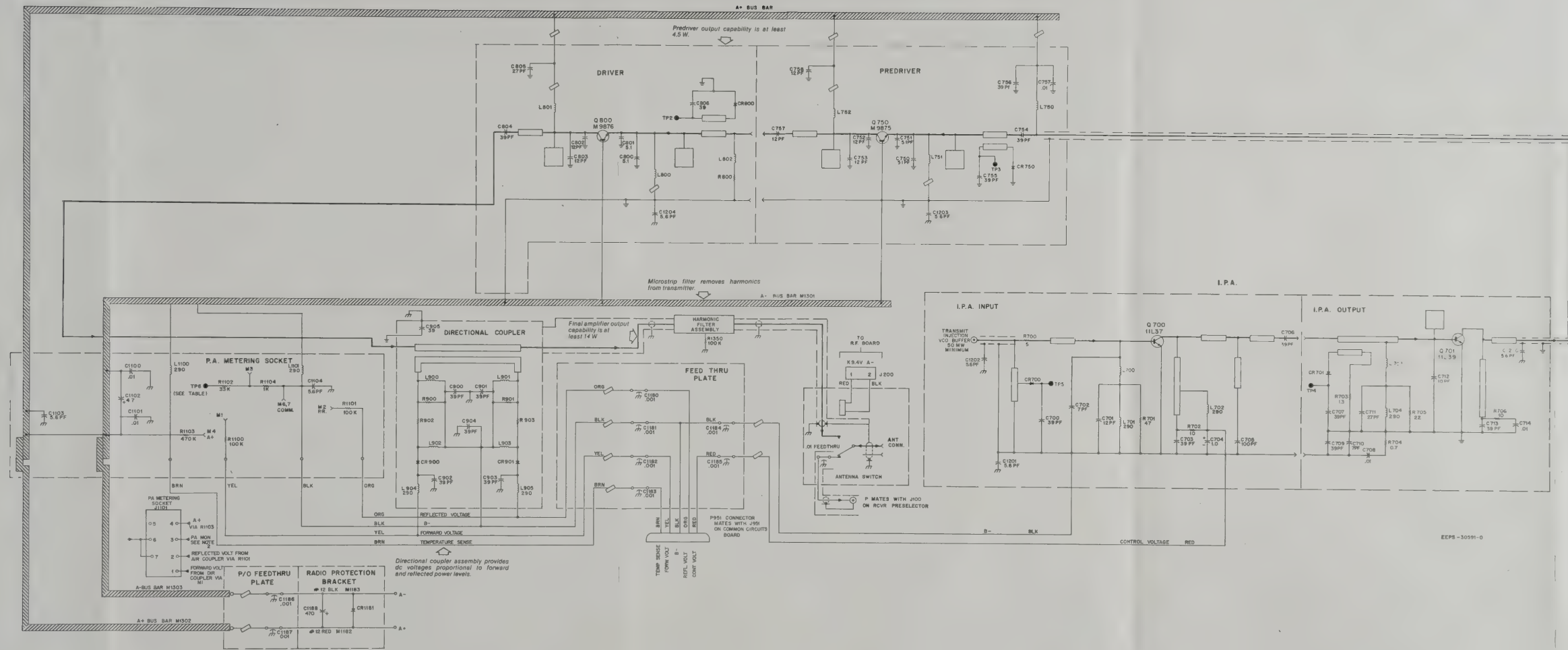
Field repair of this kit is not recommended. It should be replaced in its entirety. The following parts are listed for reference purposes only.

non-referenced items	
29-83208M01	LUG, solder; 2 used
42-80164B01	RETAINER, substrate
42-80165B01	CLIP, substrate retainer; 2 used

TRN8851A Intermediate Power Amplifier PL-7032-C

Field repair of this kit is not recommended. It should be replaced in its entirety. The following parts are listed for reference purposes only.

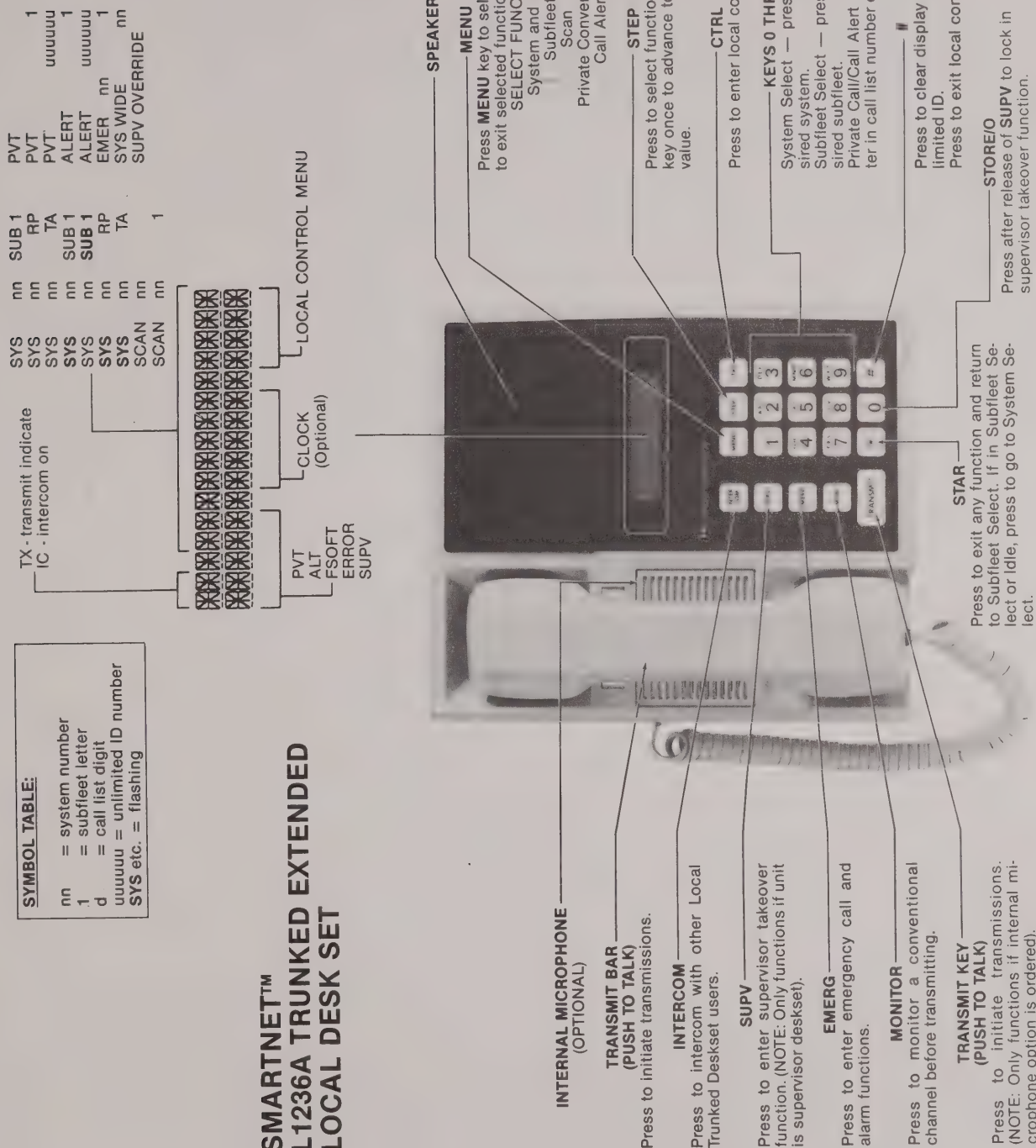
TNR8852A Pre-Driver Module		PL-7033-0
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
L750	24-5318D16	coll. res.
L751, 752	24-80202B03	11 turns choke, 4-turns wirewrt bead
G750-G752	24-8473BE15	capacitor, fixed 32 pF, $\pm 5\%$, CHIP
G756, 759	24-8473H363	30 pF, $\pm 10\%$, CHIP
G758, 766		
G757	24-8454AT11	.01, $\pm 20\%$, CHIP
non-referenced items		
	29-83208M01	LUG, solder; 3 used
	2-80164D01	RETAINER, sub-socket
	2-80165D01	CLIP, substrate 3rd order



SMABTNET™

SYMBOL TABLE:

nn	=	system number
1	=	subfleet letter
d	=	call list digit
uuuuu	=	unlimited ID number
SYS etc.	=	flashing



SYMBOL TABLE:

nn = system number
 1 = subfleet letter
 d = call list digit
 uuuuu = unlimited ID number
 SYS etc. = flashing

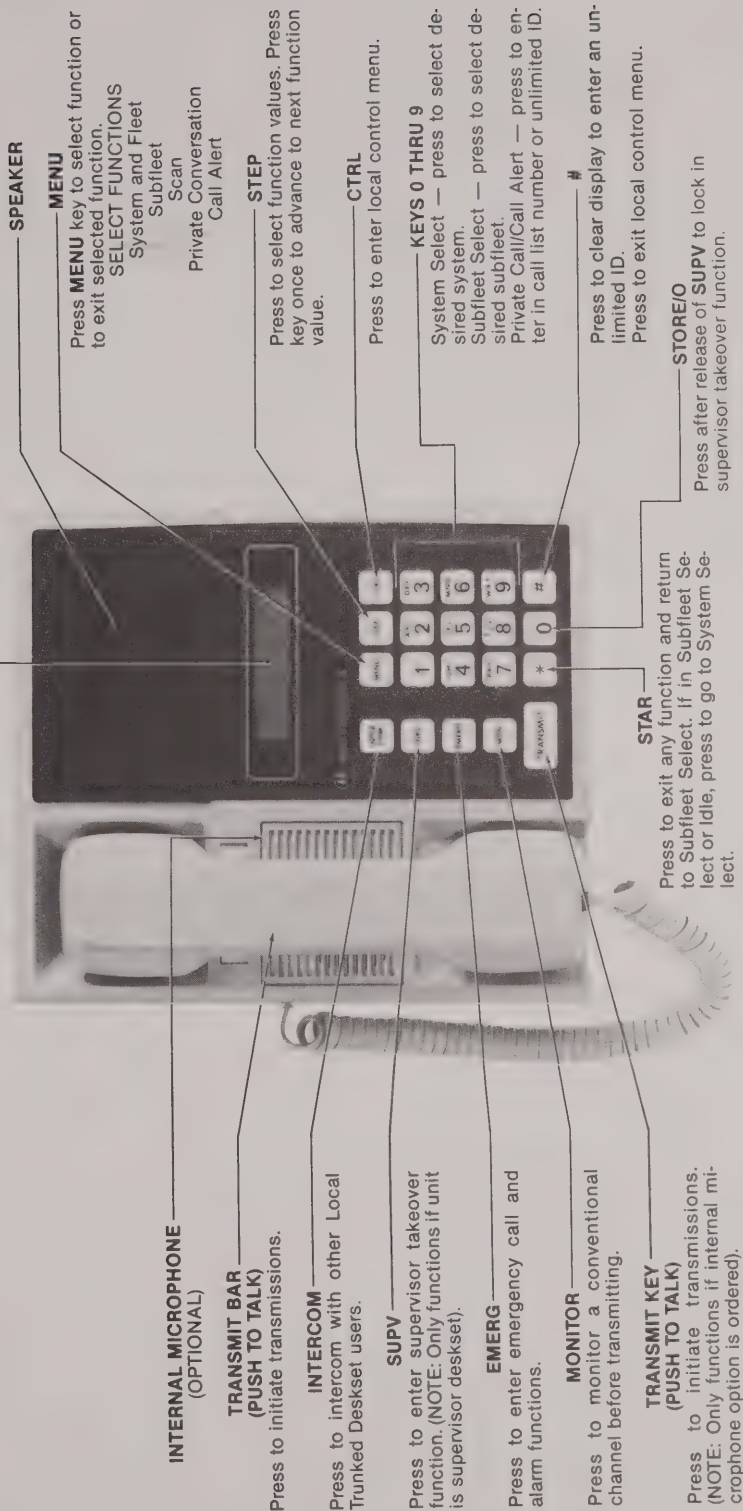
TX - transmit indicate
 IC - intercom on

SYS nn
 SYS nn
 SYS nn
 SYS nn
 SYS nn
 SYS nn
 SCAN nn
 SCAN nn

SUB 1 RP
 TA
 SUB 1
 SUB 1
 RP
 TA
 1

PVT
 PVT
 PVT
 ALERT
 ALERT
 EMER
 SYS WIDE
 SUPV OVERRIDE
 1
 uuuuu
 uuuuu
 nn
 nn

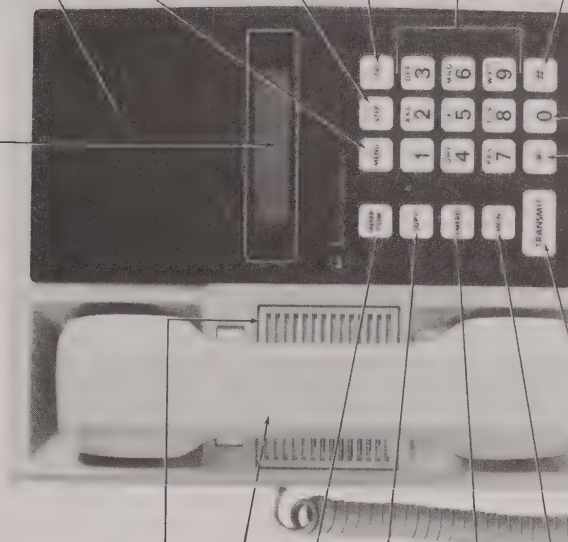
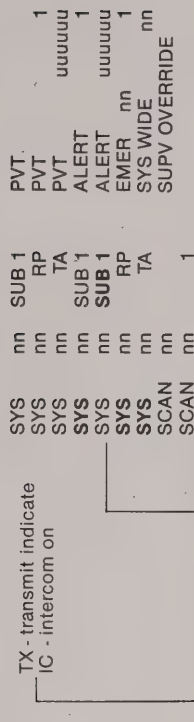
SMARTNET™ L1236A TRUNKED EXTENDED LOCAL DESK SET



SYMBOL TABLE:

nn = system number
 1 = subfleet letter
 d = call list digit
 uuuuu = unlimited ID number
 SYS etc. = flashing

SMARTNET™ L1236A TRUNKED EXTENDED LOCAL DESK SET



INTERNAL MICROPHONE
 (OPTIONAL)

TRANSMIT BAR
 (PUSH TO TALK)

Press to initiate transmissions.

INTERCOM

Press to intercom with other Local Trunked Deskset users.

SUPV

Press to enter supervisor takeover function. (NOTE: Only functions if unit is supervisor deskset).

EMERG

Press to enter emergency call and alarm functions.

MONITOR

Press to monitor a conventional channel before transmitting.

TRANSMIT KEY
 (PUSH TO TALK)

Press to initiate transmissions. (NOTE: Only functions if internal microphone option is ordered).

STAR

Press to exit any function and return to Subfleet Select. If in Subfleet Select or Idle, press to go to System Select.

SPEAKER

MENU

Press **MENU** key to select function or to exit selected function.
 SELECT FUNCTIONS
 System and Fleet
 Subfleet

Scan
 Private Conversation
 Call Alert

STEP

Press to select function values. Press key once to advance to next function value.

CTRL

Press to enter local control menu.

KEYS 0 THRU 9

System Select — press to select desired system.
 Subfleet Select — press to select desired subfleet.
 Private Call/Call Alert — press to enter in call list number or unlimited ID.

Press to clear display to enter an unlimited ID.
 Press to exit local control menu.

STORE/O

Press after release of **SUPV** to lock in supervisor takeover function.

PRIVACY PLUS™

SYMBOL TABLE:

nn	= system number
1	= subfleet letter
d	= call list digit
uuuuu	= unlimited ID number
SYS etc.	= flashing

SYS	nn	SUB 1
SYS	nn	RP
SYS	nn	TA
SYS	nn	SUB 1
SYS	nn	SUB 1
SYS	nn	RP
SYS	nn	TA

-transmit indicate
-intercom on

LOCAL CONTROL MENU

CLOCK
(Optional)

PVT
ALT
FSOFT
ERROR
SUPV

SPEAKER

MENU

Press **MENU** key to select function or to exit selected function.

SELECT FUNCTIONS
System and Fleet
Subfleet
Private Conversation
Call Alert

STEP

Press to select function values. Press key once to advance to next function value.

CTRL

Press to enter local control menu.

KEYS 0 THRU 9

System Select — press to select desired system.

Private Call/Call Alert — press to enter in call list number or unlimited ID.

我

Press to clear display to enter an unlimited ID.
Press to exit local control menu.

STORE/O

Press after release of **SUPV** to lock in supervisor takeover function.

STAR

Press to exit any function and return to Subfleet Select. If in Subfleet Select or Idle, press to go to System Select.

TRANSMIT KEY
(PUSH TO TALK)

Press to initiate transmissions.
(NOTE: Only functions if internal microphone option is ordered).

MONITOR

Press to monitor a conventional channel before transmitting.

INTERCOM.

Press to intercom with other Local Trunked Deskset users.

SUPV

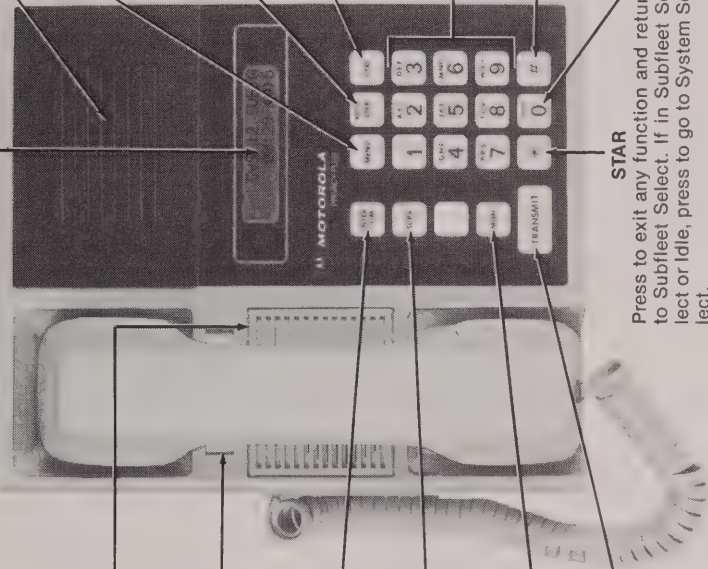
Press to enter supervisor takeover function. (NOTE: Only functions if unit is supervisor deskset).

INTERNAL MICROPHONE
(OPTIONAL)

TRANSMIT BAR
(PUSH TO TALK)

Press to initiate transmissions.

Trunked Extended Local Desk Set
Operating Overview
Motorola No. 13-SP5290317-1
6/1/88



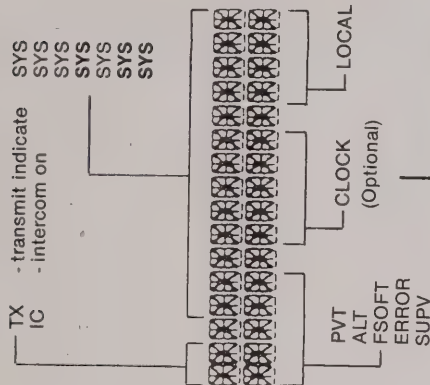
SYMBOL TABLE:

nn = system number
1 = subfleet letter
d = call list digit
uuuuu = unlimited ID number
SYS etc. = flashing

TX -transmit indicate
IC -intercom on

SYS nn SUB 1 PVT
SYS nn RP PVT
SYS nn TA PVT
SYS nn SUB 1 ALERT
SYS nn SUB 1 ALERT
SYS nn RP SYS WIDE
SYS nn TA SUPV OVERRIDE

PRIVACY PLUS™ L1261A TRUNKED EXTENDED LOCAL DESK SET



SPEAKER

MENU

Press **MENU** key to select function or to exit selected function.
SELECT FUNCTIONS
System and Fleet
Subfleet
Private Conversation
Call Alert

STEP

Press to select function values. Press key once to advance to next function value.

CTRL

Press to enter local control menu.

KEYS 0 THRU 9

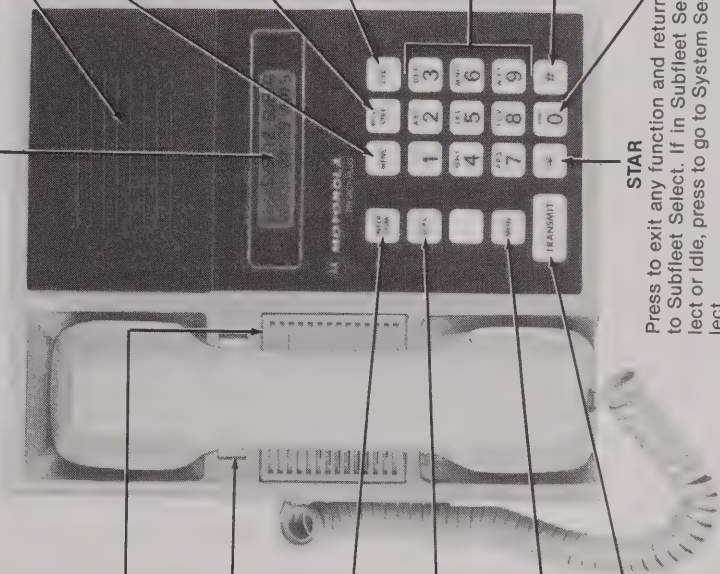
System Select — press to select desired system.
Subfleet Select — press to select desired subfleet.
Private Call/Call Alert — press to enter in call list number or unlimited ID.

#

Press to clear display to enter an unlimited ID.
Press to exit local control menu.

STORE/O

Press after release of **SUPV** to lock in supervisor takeover function.



SYMBOL TABLE:

nn = system number
 1 = subfleet letter
 d = call list digit
 uuuuu = unlimited ID number
 SYS etc. = flashing

TX - transmit indicate
 IC - intercom on

SYS SYS
 SYS SYS
 SYS SYS
 SYS SYS
 SYS SYS
 SYS SYS

SUB 1
 nn RP
 nn TA
 nn SUB 1
 nn SUB 1
 nn RP
 nn TA

PVT
 PVT
 PVT
 ALERT
 ALERT
 SYS WIDE
 SUPV OVERRIDE

LOCAL CONTROL MENU
 CLOCK (Optional)
 PVT
 ALT
 FSOFT
 ERROR
 SUPV

PRIVACY PLUS™ L1261A TRUNKED EXTENDED LOCAL DESK SET

SPEAKER

MENU

Press **MENU** key to select function or to exit selected function.
SELECT FUNCTIONS
 System and Fleet
 Subfleet
 Private Conversation
 Call Alert

STEP

Press to select function values. Press key once to advance to next function value.

CTRL

Press to enter local control menu.

KEYS 0 THRU 9

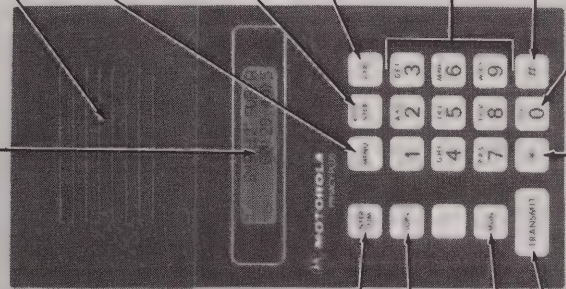
System Select — press to select desired system.
 Subfleet Select — press to select desired subfleet.
 Private Call/Call Alert — press to enter in call list number or unlimited ID.

#

Press to clear display to enter an unlimited ID.
 Press to exit local control menu.

STORE/ID

Press after release of **SUPV** to lock in supervisor takeover function.



INTERNAL MICROPHONE (OPTIONAL)

TRANSMIT BAR (PUSH TO TALK)

Press to initiate transmissions.

INTERCOM

Press to intercom with other Local Trunked Deskset users.

SUPV

Press to enter supervisor takeover function. (NOTE: Only functions if unit is supervisor deskset).

MONITOR

Press to monitor a conventional channel before transmitting.

TRANSMIT KEY (PUSH TO TALK)

Press to initiate transmissions. (NOTE: Only functions if internal microphone option is ordered).

STAR

Press to exit any function and return to Subfleet Select. If in Subfleet Select or Idle, press to go to System Select.



MOTOROLA INC.

Communications
Sector

OPTIONS L791AA/AC/AD/AE-SP

DIGITAL REMOTE CONTROL

FOR 9000 CONSOLETTES™

1. ATTACHMENTS

-- DSA Cable Wiring Detail	2-SP6590002
-- HRN4002B Digital Remote Control Adapter Board	
Schematic Diagram and Circuit Board Component Location Detail	3-SP6590002
-- Parts List	3PL-SP6590002

2. DESCRIPTION

2.1 These special digital remote control options for "SP09" series 9000 Consolettes enables operation with the Models L1236A, L1237A, L1261A and L1262A Digital Remote Control Desksets. The HRN4002B Digital Remote Control Adapter Board provides an interface between the desksets (which operate at 949 baud), the rf unit, control unit, and option boards which operate at 9600 baud. Serial bus commands from the 9600 baud side are intercepted and interpreted for the deskset(s), and 949 baud deskset commands are similarly translated for the 9600 baud side.

2.2 A dual UART on the HRN4002B provides the serial bus circuitry to communicate with two groups of up to six desksets. The HRN4002B provides audio circuitry to drive up to 1200 ft. of cable to the desksets and to buffer and provide common mode noise rejection for line audio from the remote deskset(s). Refer to the instruction manual supplied with the "SP09" Consolette for information regarding operating or servicing of the control stations.

3. MODEL COMPLEMENT

The L791__-SP options are used with, and make the following changes to, the respective "SP09" Consolette.

technical writing services

1301 E. Algonquin Road, Schaumburg, IL 60196

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UP-5/90

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68P06910E17-0
(1S-SP6590002)

OPTION	OPTION	OPTION	OPTION	DESCRIPTION
L791AA-SP For:	L791AC-SP For:	L791AD-SP For:	L791AE-SP For:	Digital Remote Control
L35KEB7174BMSP09	L35KXB7174BMSP09	L44FXB5174BMSP09	L44VLB5174BMSP09	
L35VLB5174CMSP09	L35FXB5174BMSP09	L44KXB7174BMSP09	L44KEB7174BMSP09	
		L64FXB5170BMSP09	L64VLB5170BMSP09	
		L64KXB7170BMSP09	L64KEB7170BMSP09	
		L64KXB7174BMSP09	L64KEB7174BMSP09	
CHANGES				
DELETE YRN4005A	DELETE YRN4006A	DELETE YRN4007A	DELETE YRN4008A	Chassis and Panel
DELETE TMN1005B	DELETE TMN1005B	DELETE TMN1005B	DELETE TMN1005B	PL Base Microphone
ADD	ADD	ADD	ADD	
YRN4009A	YRN4010A	YRN4011A	YRN4012A	Chassis and Panel
HKN4352A	HKN4352A	HKN4353A	HKN4353A	Cable, Radio to DRC Board
HLN5480A	HLN5480A	HLN5480A	HLN5480A	Dig. Remote Control Firmware
HMN1063A	HMN1063A	HMN1063A	HMN1063A	Base Microphone
HRN4002B	HRN4002B	HRN4002B	HRN4002B	Digital Remote Control Board
HKN4351A	HKN4351A	HKN4351A	HKN4351A	Cable, Control Head to DRC Board

4. DIGITAL REMOTE DESKSET CONNECTIONS

The *Consolette* is provided with a DB25 female connector on the back panel of the radio. Refer to the figure for location of the connector and to Table 1 for the proper connections.

Table 1. Digital Remote Deskset to Control Station Connections

DB25 Connector J4	Deskset Signal Definition
J4-7	GND
J4-11	A+
J4-12	Tx Audio+
J4-13	Tx Audio-
J4-15	Rx Audio+
J4-16	Rx Audio-
J4-18	Serial Bus+
J4-19	Serial Bus-

5. OPERATION

5.1 OPERATION FROM CONSOLETTTE FRONT PANEL

The control unit mounted in the front panel of the *Consolette* is identical to the Systems 9000™ mobile control units. Refer to the included manuals and the operators card for information on front panel controls.

5.2 DIGITAL REMOTE DESKSET OPERATION

The manual included with the separately supplied deskset describes it's operation with the trunked remote only *Consolette* (L35VLB5174A/BMSP06). Refer only to the following for operating instructions with the L791__-SP Digital Remote Control Option.

5.2.1 Deskset controls consist of a telephone style keypad for entry of numeric data such as mode numbers and private call ID's. Intercom, Supervisor, Emergency, Monitor, and Transmit keys are for direct control of these functions. The Control key enables a local control menu which allows the operator to change settings of the deskset such as LCD display viewing angle, speaker volume, handset earpiece volume and microphone sensitivity. The Menu, Step and Star (*) keys are for accessing radio features such as Channel Scan™, Call Alert™, and Page.

5.2.2 The digital remote deskset has a 32 character display arranged in two lines of 16. The top line displays information relating to control of radio functions. Refer to the deskset control panel diagram at the rear of this manual for the following description.

- The first digit of the top line can display three things:
 - T - indicating the transmitter is on.
 - I - indicating that the desksets are in intercom.
 - B - indicating channel activity in conventional modes.
- Position two of the top line is reserved for SECURENET™ radios to give a positive indication (0) that the radio is transmitting in the encrypted mode. Press the zero (0) key to toggle between to clear and encrypted modes.
- Position three is a space holder; for clarity in reading the display nothing will be written there.
- The rest of the top line will display the following messages:

DISPLAY	INDICATION
SELF CHK	Radio is performing diagnostic test after power-up.
SUPV OVERRIDE	The deskset programmed as the supervisor unit has locked out the other desksets by pressing the SUPV key. Intercom is the only function that will operate on the deskset.
MODE nnn	Shows the presently selected mode where nnn is a 3 digit number. Leading zeros are not displayed. Press STEP key to advance through programmed radio modes. Press MENU key to step through available radio functions (including keyboard entry of Modes) and press the star (*) key to select that function. On radios with System/Subfleet control units, press the star (*) key to toggle the STEP key function between system selection and subfleet selection.
XXX XXX DIR	DIR indicates Talk-around. Press pound (#) key to toggle on and off. Only functions on conventional modes which are programmed to enable Talk-around. Can be selected while scanning conventional channels or in addition to other menu selected functions.

DISPLAY	INDICATION (cont'd.)
MODE (FLASHING)	Menu display. Press star (*) key to enable keypad selection of mode number or press STEP key to advance through menu.
MODE _ _ _	Keypad mode selection is enabled. Key in a valid mode number and press the star (*) key to enter or press MENU key to exit without changing selected mode. Press pound (#) key to find out radio Dynamic Regrouping status.
DREG ON	Consolette is operating on the regrouped talk group. (Dynamic Regrouping On)
DREG OFF	Consolette has not been granted operation on the regrouped talk group. (Dynamic Regrouping off.) Press star (*) key to request regrouping.
DREG WAIT	Dynamic regrouping has been requested. Wait for an acknowledgment from the dispatcher.
DREG ACKD	Dynamic regrouping has been granted.
DREG NO ACK	Dynamic regrouping has NOT been granted.
OUT OF RANGE	Radio is out of range of the trunking system or the system is out of service. OUT OF RANGE will alternate with MODE nnn.
SCAN (FLASHING)	Menu display. Press star (*) key to enable <i>Channel Scan</i> or press STEP key to advance through menu.
SCAN nnn	<i>Channel Scan</i> has been enabled. "nnn" is the presently selected Mode.
EMER nnn	Emergency call has been enabled. "nnn" is the presently selected Mode.
CALL (FLASHING)	Menu display. Press star (*) key to enable Private Call or press STEP key to advance through menu.
CALL SCRATCH	Private Call call has been enabled. This display alternates between last ID number called or CALL _ _ _ _ _ if scratch pad is empty. Press Push-To-Talk to call unit in scratch pad or key in new 6-digit ID. Press STEP key to advance through stored unit ID's in the Call List or continue to press step key until CALL STORE ID is displayed to enter a new unit ID in the call list.

DISPLAY	INDICATION (cont'd.)
CALL nnnnnn	Private Call unit ID number. This display will alternate with a description of where this ID is stored, CALL SCRATCH if in scratch pad memory, CALL UNIT n if in the stored call list or CALL THIS ID if the ID of the <i>Consolette</i> is displayed. Press Push-To-Talk to place a Private Call to this unit. Press STEP to advance through Call List. If desired 6-digit ID is not in the Call List or scratch pad memory, key in new 6-digit ID from the scratch pad display. (Unlimited Call only)
CALL UNIT n	Private Call unit ID from the stored Call List (Unlimited Call only) or from the list preprogrammed with the field programmer.
CALL STORE ID	Press star (*) to edit 6-digit ID Call List (Unlimited Call only), display will alternate between CALL UNIT n and CALL nnnnnn. Press STEP to review call list or key in new 6-digit ID and press star (*) to store. Press STEP to advance to CALL THIS ID display or press MENU to return to MODE nnn display.
CALL THIS ID	Display alternates between CALL THIS ID and CALL nnnnnn to indicate ID of <i>Consolette</i> . Follows CALL STORE ID in Private Call menu. Press MENU to return to MODE nnn display or press STEP to return to CALL SCRATCH display.
CALL BAD ID	Indicates ID selected is not in selected talk group. Check 6-digit ID or mode selection for correctness.
CALL RCVD ID	Display alternates between CALL nnnnnn and CALL RCVD ID. Indicates reception of a Private Call from the unit indicated in CALL nnnnnn display.
PAGE (FLASHING)	Menu display. Press star (*) key to enable <i>Call Alert</i> Page or press STEP key to advance through menu.
PAGE SCRATCH	<i>Call Alert</i> Paging has been enabled. This display alternates between last ID number paged or PAGE _ _ _ _ _ if scratch pad is empty. Press star (*) to call unit in scratch pad or key in new 6-digit ID (Unlimited Call only). Press STEP key to advance through stored unit ID's in the Call List or continue to press step key until PAGE STORE ID is displayed to enter a new unit ID in the call list.
PAGE nnnnnn	<i>Call Alert</i> Page unit ID number. PAGE nnnnnn will alternate with a description of where this ID is stored, PAGE SCRATCH if in scratch pad memory, PAGE UNIT n if in the stored call list or PAGE THIS ID if the ID of the <i>Consolette</i> is displayed. Press star (*) key to page this unit.

DISPLAY	INDICATION (cont'd.)
PAGE UNIT n	<i>Call Alert</i> Page unit ID from the stored call list or from the list preprogrammed with the field programmer. Press the star (*) key to page this unit. Press step to advance through call list. If the desired 6-digit ID is not in the Call List or scratch pad memory, key in a new 6-digit ID from the scratch pad display (Unlimited Call only). Press MENU to return to MODE nnn display and exit <i>Call Alert</i> Paging.
PAGE STORE ID	(Unlimited Call only). Press star (*) to edit 6-digit ID Call List, display will alternate between CALL UNIT n and CALL nnnnnn. Press STEP to review Call List. Key in new 6-digit ID and press star (*) to store in selected location. Press STEP to advance to CALL THIS ID display or press MENU to return to MODE nnn display and exit <i>Call Alert</i> Paging.
PAGE THIS ID	Display alternates between PAGE THIS ID and PAGE nnnnnn to indicate ID of <i>Consolette</i> . Follows PAGE STORE ID in Private Call menu. Press MENU to return to MODE nnn display. Press STEP to return to PAGE SCRATCH display.
PAGE BAD ID	Selected ID is not in current talk group. Check 6-digit ID or mode selection for correctness.
PAGE ACKD	<i>Call Alert</i> Page was transmitted and receiving unit acknowledged the Page.
PAGE NO ACK	<i>Call Alert</i> Page was transmitted but receiving unit did NOT acknowledge the Page.
PAGE WAIT	<i>Call Alert</i> Page is being transmitted.
PAGE RCVD ID	Display alternates between PAGE nnnnnn and PAGE RCVD ID. Indicates reception of a <i>Call Alert</i> Page from the unit indicated in PAGE nnnnnn display.

Pressing the CTRL (control) key will cause the deskset to display local control menu functions in the bottom row of 16 characters. To advance through the functions, continue pressing the CTRL key. To exit the local control menu press the pound (#) key. All of the local control menus will time out after several seconds reverting to normal deskset operation with any new settings entered. Listed below are the local control displays and a description of the functions.

DISPLAY	DESCRIPTION
PRESS 0 TO SLEEP	Pressing the 0 key when this is displayed will put the deskset in an inactive state. No calls will be received, Push-to-Talk will be disabled and the display will appear blank. Press any key to return to normal deskset operation from the "sleeping" state.

DISPLAY	DESCRIPTION (cont'd.)
SPEAKER VOLUME n	Pressing for any key from 1 to 9 will change the speaker volume, 1 for very soft and 9 for very loud. The display will show the new relative volume (n). The speaker volume can also be adjusted by simply pressing a number key while a call is being received without using the CTRL button to step to this function.
HANDSET VOLUME n	Pressing any key from 1 to 9 will change the handset volume, 1 for very soft and 9 for very loud. The display will show the new relative volume (n). Press pound (#) to enter change or CTRL to advance to the next local control menu display. The handset volume can also be adjusted by simply pressing a number key with the handset off hook while a call is being received without using the CTRL button to step to this function.
12 HR (1=12, 2=24)	If the deskset is ordered with the optional clock, pressing 1 or 2 will change the clock to display 12 or 24 hour format. Press pound (#) to enter change or CTRL to advance to the next local control menu display.
CLOCK HR: MN	If the deskset is ordered with the optional clock, pressing keys 0-9 for hours and minutes will adjust the clock setting to the correct time. Press pound (#) to enter change or CTRL to advance to the next local control menu display.
HNDST MIC GAIN n	Pressing keys 1-5 will adjust the sensitivity of the handset microphone. Higher sensitivity (greater numbers) should be used for softer speakers in a low noise environment. Lower sensitivity (smaller numbers) should be used by people with louder voices or in a high noise environment. Press pound (#) to enter change or CTRL to advance to the next local control menu display.
KEYCLICK VOL n	Pressing a key from 0-9 adjusts the volume of the click produced by pressing any key giving a positive indication that the key was pressed. Press pound (#) to enter change or CTRL to advance to the next local control menu display.
VIEWING ANGLE n	Pressing a key from 1-9 adjusts the optimum viewing angle of the LCD display. Press pound (#) to enter change or CTRL to advance to the next local control menu display.

During normal deskset operation the first five characters of the bottom line can display the following messages:

DISPLAY	INDICATION
CALL	A Private Call has been received.
PAGE	A Call Alert Page has been received.

DISPLAY

INDICATION

FSOFT	The trunking central controller is in failsoft.
ERROR	The deskset is not receiving digital communications from the <i>Consolette</i> . Check to see that the <i>Consolette</i> is operating correctly from the front panel and that all connections between the deskset and the <i>Consolette</i> are correct.
SUPV	The deskset programmed as the supervisor unit has locked out all other desksets. Only the intercom function will operate until the supervisor unit leaves the override mode.

The sixth character of the bottom row is a space holder; for clarity in reading the display, nothing will be written there except in the local control menu.

Positions 7 through 11 will display the time if the deskset is equipped with the clock option.

6. HRN4002B DIGITAL REMOTE CONTROL ADAPTER BOARD (DRC) THEORY OF OPERATION

6.1 MICROCOMPUTER, ADDRESS DECODERS, AND MEMORY CIRCUITS

Microcomputer U103 executes a program stored in EPROM U107. U103 addresses U107 by means of the Address Decoders U104, U105, U110, U111, U113 and U114. These ICs decode the microcomputer data and address lines (pins 9 through 16 and 27 through 38). A SRAM (U106) is used for scratch pad and system stack operations.

6.2 SERIAL COMMUNICATIONS

The digital remote desksets communicate with the DRC board via a serial bus that carries data at a baud rate of 949.2 to duplicate most of the operation of the control head used by the *consolette* radio. When the DRC board receives a message from a deskset, the DRC board interprets the message and sends the appropriate command to the radio using the 9600 baud serial bus. A display message sent by the radio is received and interpreted by the DRC board, which then sends a suitable message to the desksets via the 949.2 baud serial bus.

To handle these communications, U103 uses a DUART (U108) to handle the data transmissions to/from the desksets. The DUART accumulates any incoming data received at U108-10 from the desksets and signals U103 via U108-21 when the complete data message is received. Q110, Q113 and Q114 (and related circuitry) are used to convert the received logic levels to acceptable levels for the DUART.

If U103 needs to send a command to the desksets, it will transfer the command to the DUART via the address and data lines. The DUART then will transmit the command to the desksets via U108-11. Q109, 111 and 112 and related circuitry are used to convert the DUART signal levels to the appropriate bus logic levels.

6.3 AUDIO COMMUNICATIONS PATHS

6.3.1 TRANSMIT AUDIO PATHS

The transmit audio section is used to transfer audio originating at a console or other remote control device to the *consolette* radio for transmission over the air or intercommunication between desksets. The transmit audio can be routed to the radio from any one of several different input paths.

The DRC board is designed to accept audio inputs from one of the five following sources:

- Local Control Desksets
- Local *Consolette* Microphone
- Tone or DC Remote Deskset (with appropriate *consolette* software)
- Local Control Deskset With 8-Wire Phone Connector and Appropriate Software.

All audio sources are applied to the input of the Line Summing Amplifier, U302D. this amplifier injects the transmit audio into the radio via the mic audio input connector J1 pin 11. The audio input to U302D is one of the following paths:

- Local Control Desksets:

Audio is input to the DRC board via DB-25 connector J4. Transmit audio is received on pins 12 and 13 and then passes through amplifier U302A to U302D.

- Local Console Microphone:

Audio is input to the DRC board via connector J6. The Mic Audio applied to J6-5 gets the 9.6V DC bias through R360, R361, C338 and R366 and is then applied to amplifier U302D.

- Tone Remote Deskset:

Audio is input to the DRC board from the optional Tone Remote Control Decoding board via connector J5. Transmit audio is received on J5-22 and is ac coupled directly to U302D. Note that this option requires special *consolette* software not normally supplied.

- DC Remote Deskset:

Audio is input to the DRC board via connector J5. The DC audio applied to J5 pins 23 and 24 is coupled using T301. Resistors R364 and R365 supply inductive protection and the audio coupled through pins 11 and 12 of T301 is level adjusted by variable resistor R350. When DC remote is not used, R350 must be adjusted so that it does not create any audio looping. Note that this option requires special *consolette* software not normally supplied.

- Local Control Deskset With 8-Wire Phone Connector:

Transmit audio is applied to the DRC board via connector J8 pins 3 and 8. The digital remote differential audio pair applied to pins 3 and 8 is terminated with a 1k resistor, R357. DC is blocked by C332 and C333 while the AC noise is rejected by high CMRR U302-C with unity gain.

After passing through one of these paths, the transmit audio is applied to the radio as if it were microphone audio.

6.3.2 INTERCOM AUDIO PATH

During a transmit, all desksets connected to the *consolette* will be enabled so that the audio can be heard by all desksets. When an intercom is desired, audio must be routed to, and through the radio even though no transmit is required since the radio is the central tie point for all audio paths. To accomplish this feature, the audio applied to MIC HI can be RX AUD so as to be available for the other desksets. If the audio is to be intercommed, a logic high on INTERCOM ENA from the digital control section of the DRC board is applied to Q306 to turn on Q305. At the same time, a message is sent to the radio to route the audio through the radio circuits from RX AUD to FILT AUD. A logic low on INTERCOM ENA turns off Q305 and the path is disconnected.

6.3.3 RECEIVE AUDIO PATH

The receive audio section is used to transfer audio originating at the *consolette* radio to a console or other remote device. The audio from FILT AUD is applied to the phase splitter to generate a differential signal. Transistors Q307 and Q308 (with biasing circuitry) form this differential signal driver. The differential signals are applied to two similar line driver circuits. The first line driver is formed by Q309 and Q310 and is impedance matched to the load by R343. The output of this line driver is coupled through audio transformer T301 and is available for output to the DC remote control option at J5 pins 23 and 24. The other line driver is formed by Q311 and Q312 and is impedance matched by R367. Transformer T302 is used to distribute the audio to the desksets via J4, J5, J7 and J8. The audio level is adjusted by R325 (full counter-clockwise for maximum drive).

7. TROUBLESHOOTING GUIDE

The following troubleshooting information may be used to debug most system problems associated with the operation of the special *consolette* with desksets. If actual component problems are suspected with the HRN4002B DRC board, it is recommended that a Motorola Service Representative be consulted.

7.1 BASIC SYSTEM PROBLEMS

7.1.1 AT CONSOLETTTE POWER UP "SELF CHK" REMAINS VISIBLE ON THE CONSOLETTTE CONTROL HEAD (HOME MODE NEVER DISPLAYED)

This problem can typically point to a wiring error on the control cable from the *consolette* to the desksets or to the junction box. Recheck the cable wiring. If OK, then check if power is being supplied to the HRN4002B DRC board (connector J1 pin 1 should measure approximately +13.8 Volts DC with respect to J1 pin 24). If this checks OK, then perform the following steps:

Step 1. Make sure that pin 3 of U101 is at 5V, $\pm 5\%$.

Step 2. U102 through U116 are powered by the 5V noted in Step 1. If any of these ICs are not powered correctly, the HRN4002B DRC board needs service.

Step 3. Make sure U103 pin 39 is logic high. If not, one of the external reset circuits is faulty.

Step 4. If none of the previous steps solved the problem, contact your Motorola Service Representative.

7.1.2 AT CONSOLETTTE POWER UP THE CONSOLETTTE CONTROL HEAD DISPLAY SHOWS THE CORRECT HOME MODE BUT THE DESKSET DISPLAY IS BLANK

Press the MENU key on the deskset twice. The upper line of the deskset display should now match the *consolette* control head. If not, and the lower line of the deskset display now shows "ERROR", check the cable wiring between the deskset and the *consolette*.

7.1.3 AT CONSOLETTA POWER UP THE CONSOLETTA CONTROL HEAD DISPLAY
NEVER LIGHTS AND THE DESKSETS DO NOT HAVE A DISPLAY

Step 1. Check power supply fuse; replace if defective.

7.2 AUDIO PATH PROBLEMS

7.2.1 INTERCOM AUDIO: WHEN TRANSMITTING OR TRYING TO INTERCOM BETWEEN
DESKSETS, AUDIO AT RECEIVING END IS LOW LEVEL AND DISTORTED

Verify that the audio level at each deskset is set high enough to provide good audio at the deskset speaker. Verify that the desksets are set far enough apart to prevent feedback between units. If neither of these methods solves the problem proceed to Step 1.

NOTE

When a 0 dBm signal is applied to any audio source, there should be a 0 dBm signal at pin 14 of U302D. If the signal is missing, turn potentiometer R350 on the HRN4002B DRC board fully clockwise and perform the following steps.

Step 1. Verify that $4.8V \pm 5\%$ is at U301B pin 7. If OK, go to Step 2. If not, go to Step 5.

Step 2. Apply a 0 dBm signal (600 Ohms) at 1 kHz to pins 23 and 24 of J5.

Step 3. Monitor the signal at U302D pin 14. If OK, repeat Steps 2 and 3 for pins 22 and 3 of J5 and pin 5 of J6 with DC coupling. If not OK for all, U302 is defective. If only partly OK, the series R and C for corresponding path is bad.

Step 4. Repeat Steps 2 and 3 for J5 pins 5 and 7, J7 pins 6 and 8, and J8 pins 3 and 8. If all or parts of these paths are bad, U302 is defective.

Step 5. Verify J1 pin 4 is between 10.5 and 15V. If not, J1 cable is defective. Measure VBE of Q302 and Q303. VBE should be $0.7V \pm 5\%$, otherwise corresponding transistor is defective. If both transistors are OK, replace U301.

Step 6. If intercom is not functioning, make sure the audio signal is at U302D pin 14, and measure VEB of Q305 and Q306 ($0.7V \pm 5\%$). If not there, then the corresponding transistor is defective.

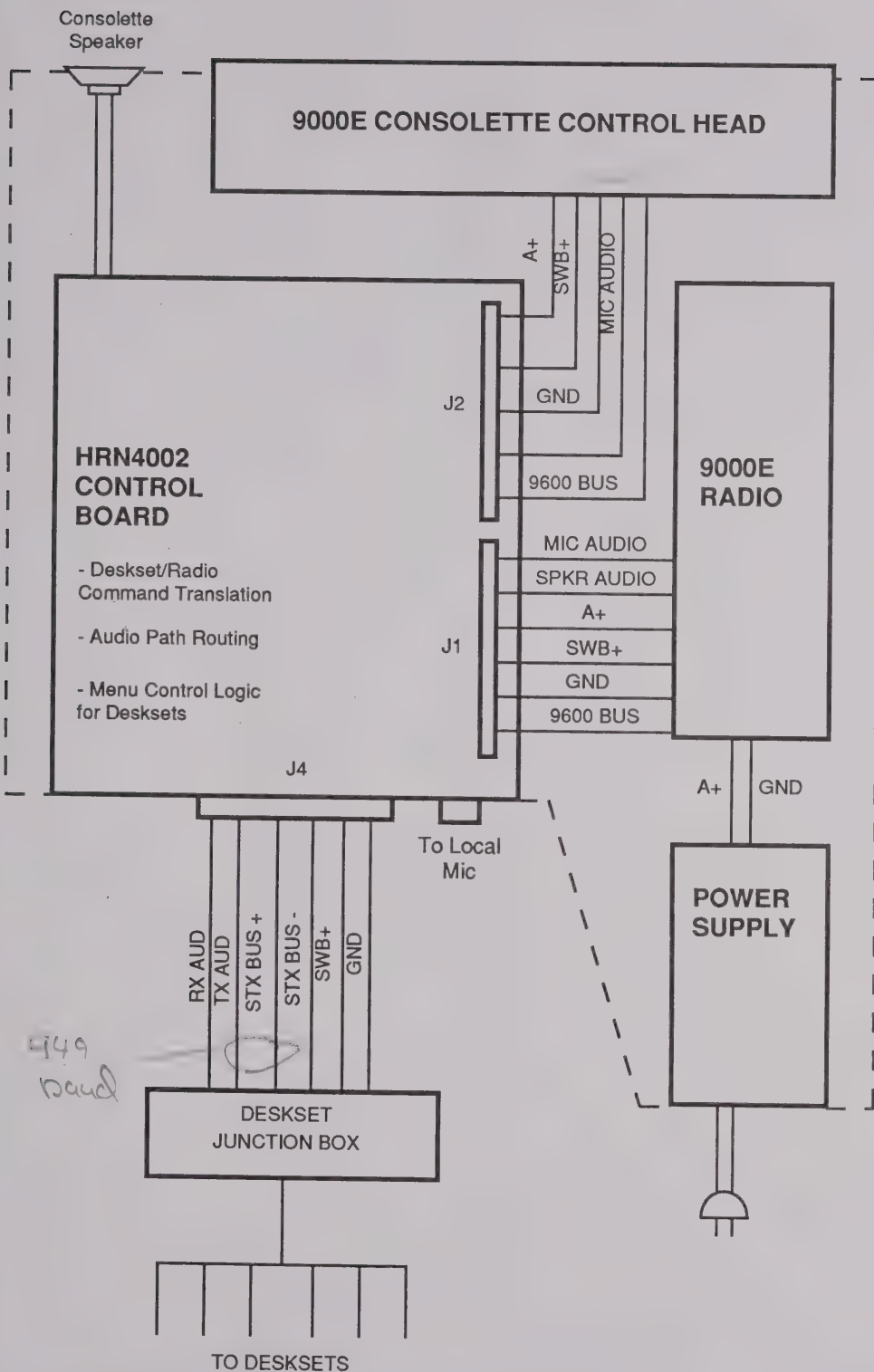
7.2.2 RECEIVE AUDIO PROBLEMS

If the receive audio path is suspected, perform the following steps.

Step 1. Check that the cable to the desksets is connected correctly.

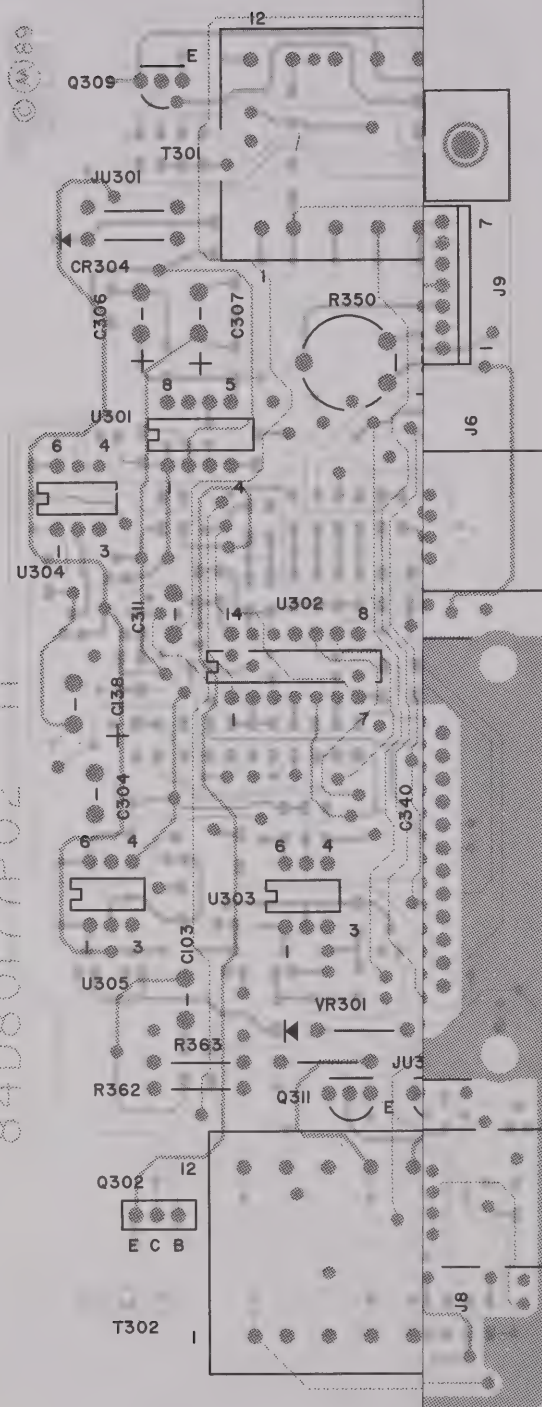
Step 2. Verify that SWB+ is between 10.5 and 15V.

Step 3. Measure VEBs of Q307 through Q312. All should be between 0.5 and 0.8V. Replace any transistor if bad.

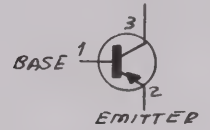


9000E CONSOLETTA SYSTEM DIAGRAM

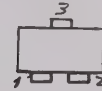
84D80177P02 T1



COLLECTOR

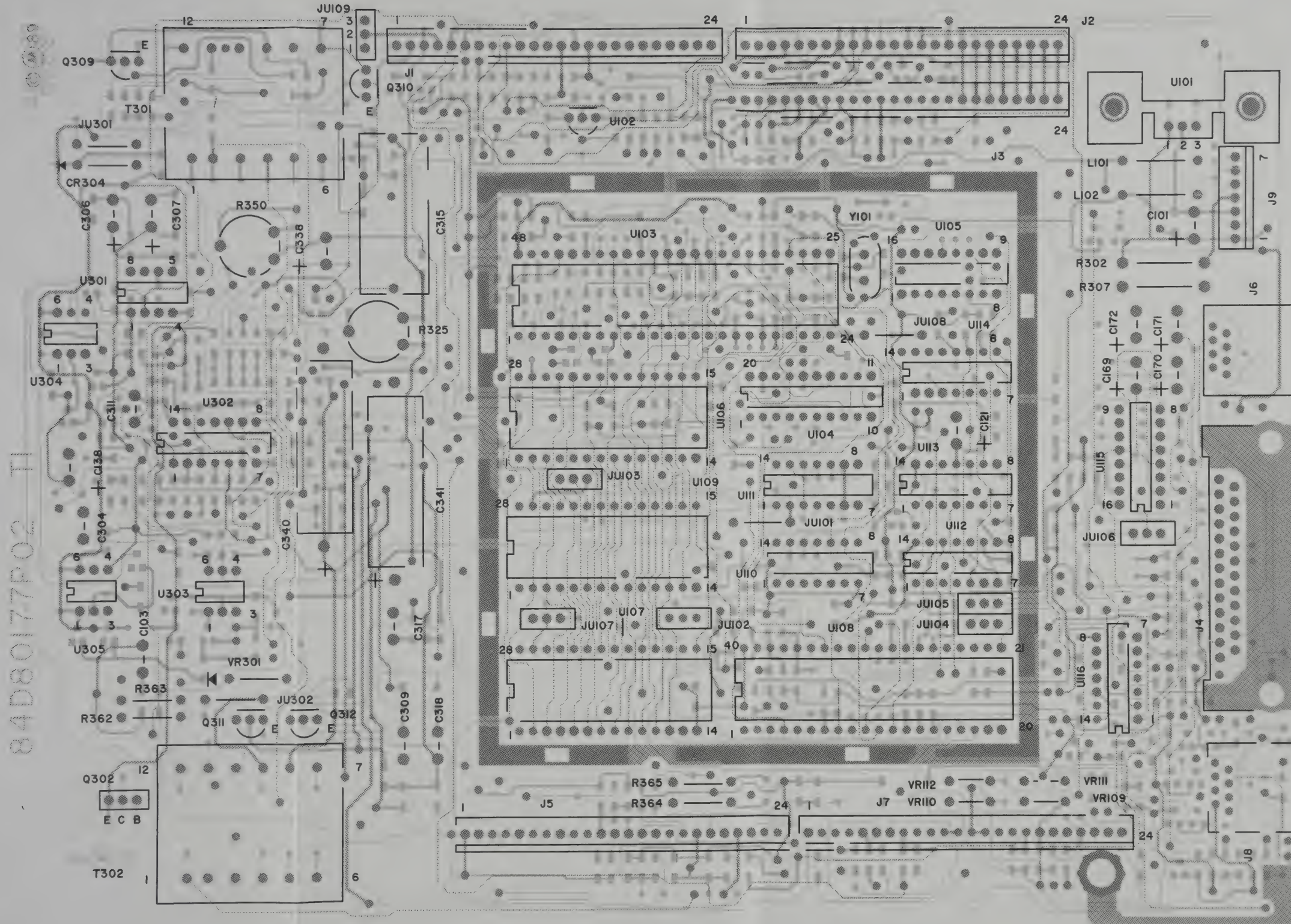


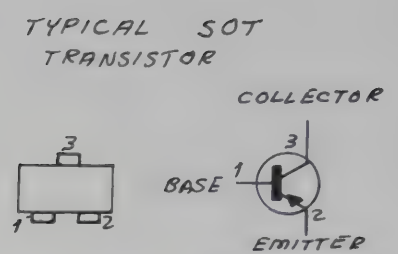
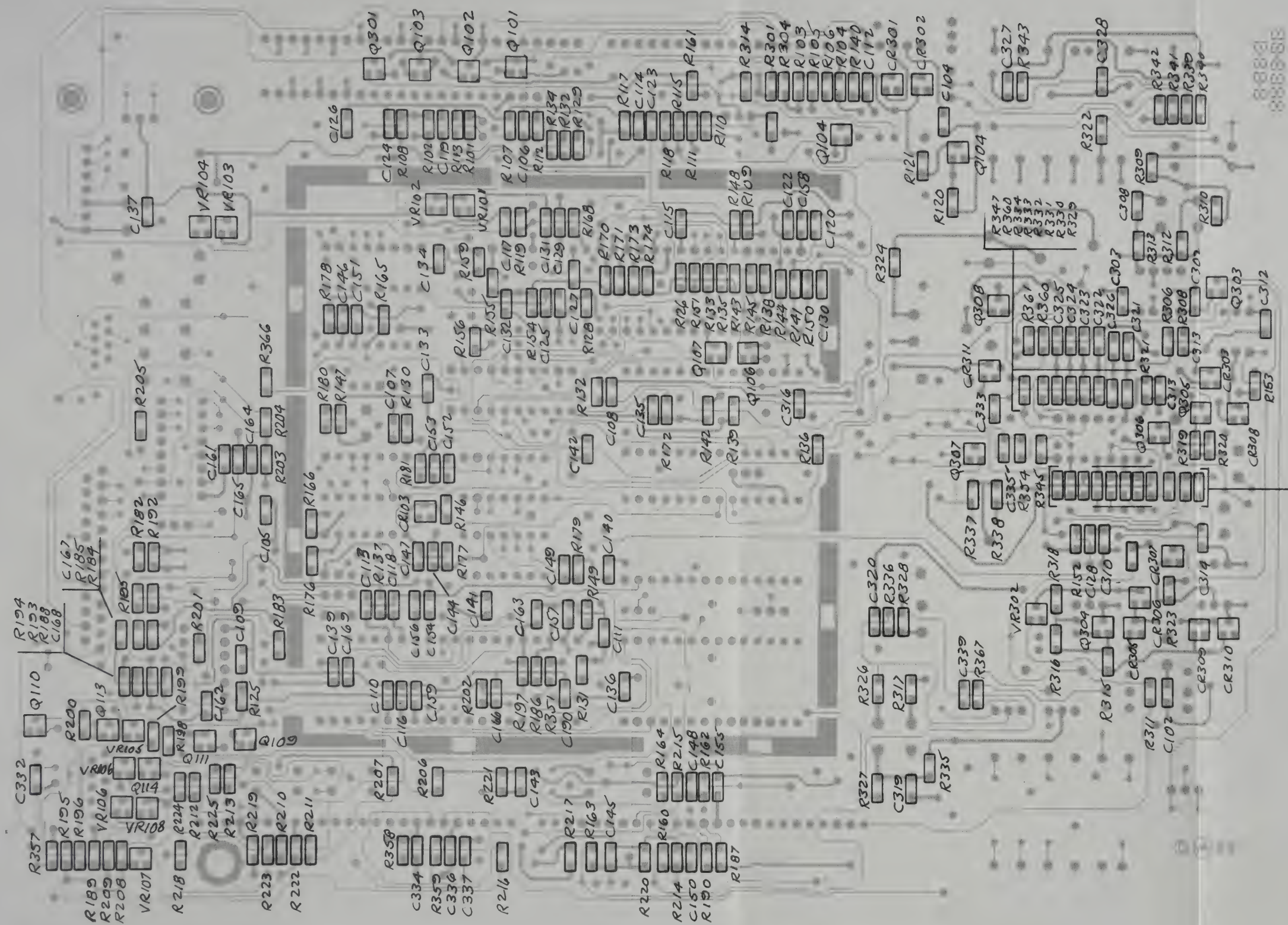
TYPICAL SOD DIODE



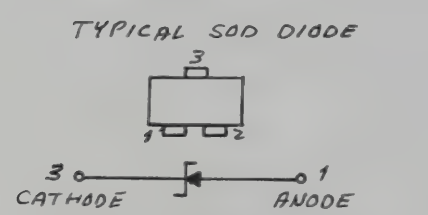
R353
C350
R348
C305
R346
R356
C331
R345
R355
C329
R344

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(SHEET 2 OF 5)





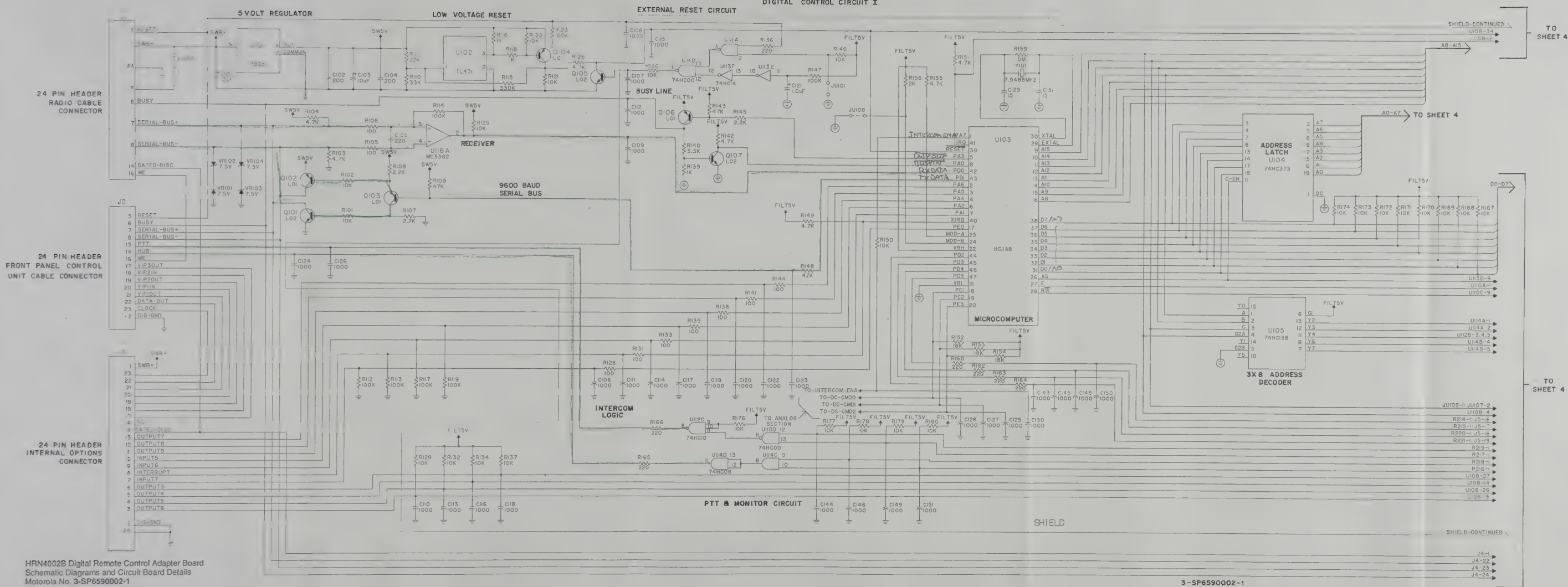
ALL OTHER TRANSISTORS ARE AS MARKED



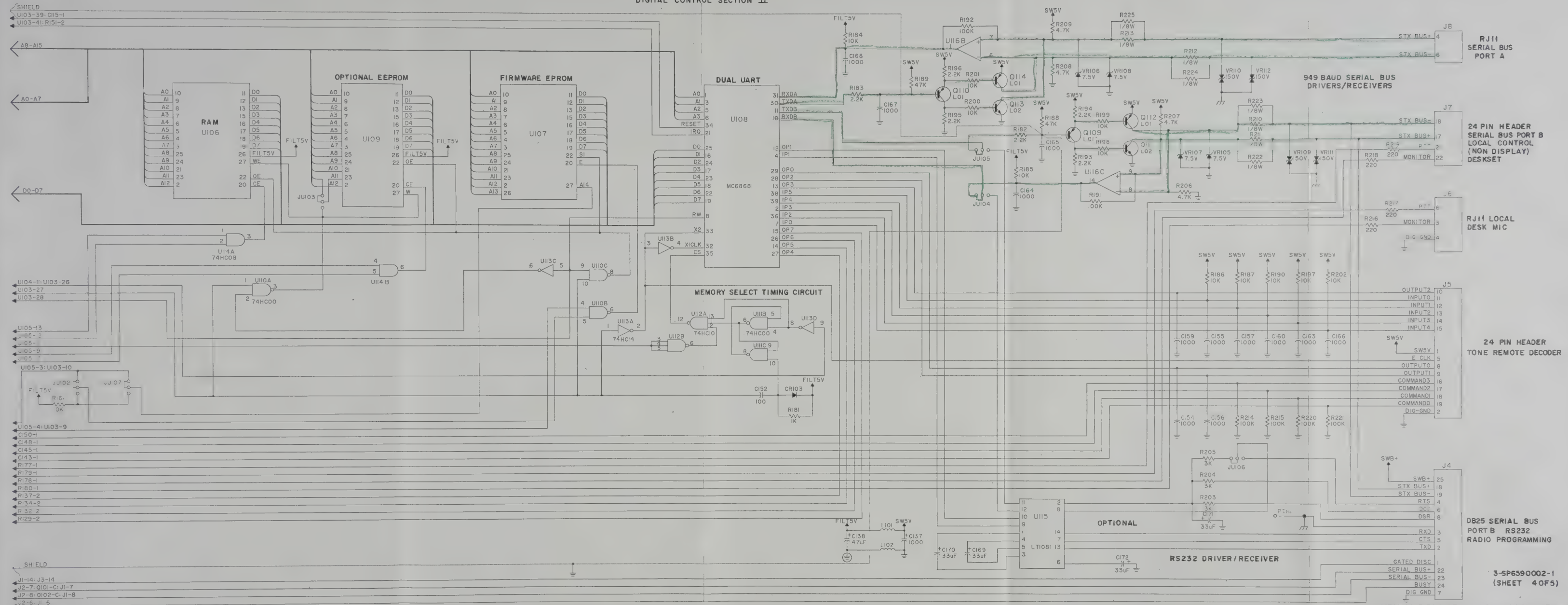
ALL OTHER DIODES AS MARKED

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- R350
- R348
- R345
- R346
- R356
- R331
- R340
- R355
- R344

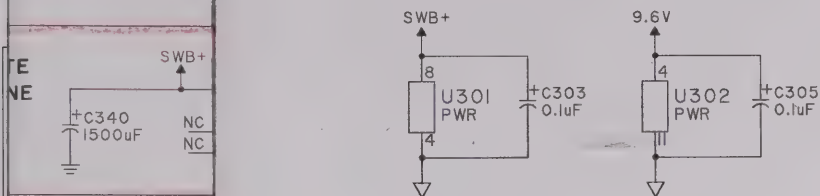
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(SHEET 2 OF 5)



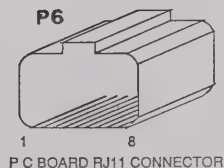
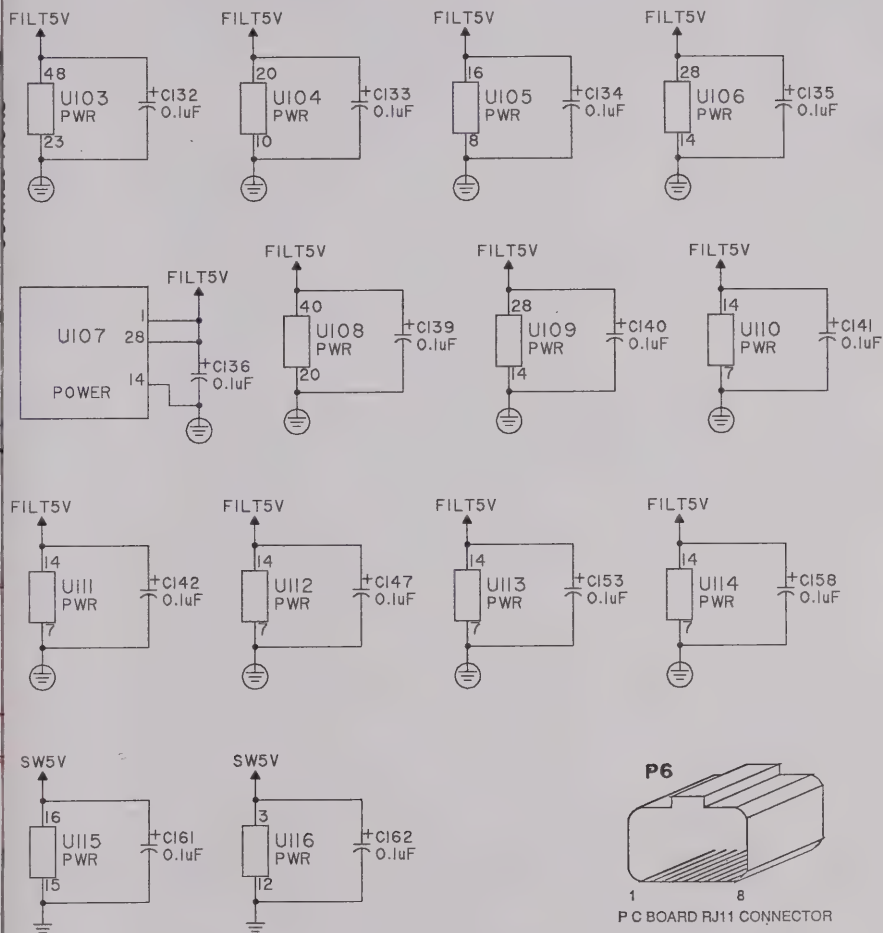
DIGITAL CONTROL SECTION II



DIGITAL SECTION POWER AND GROUNDS

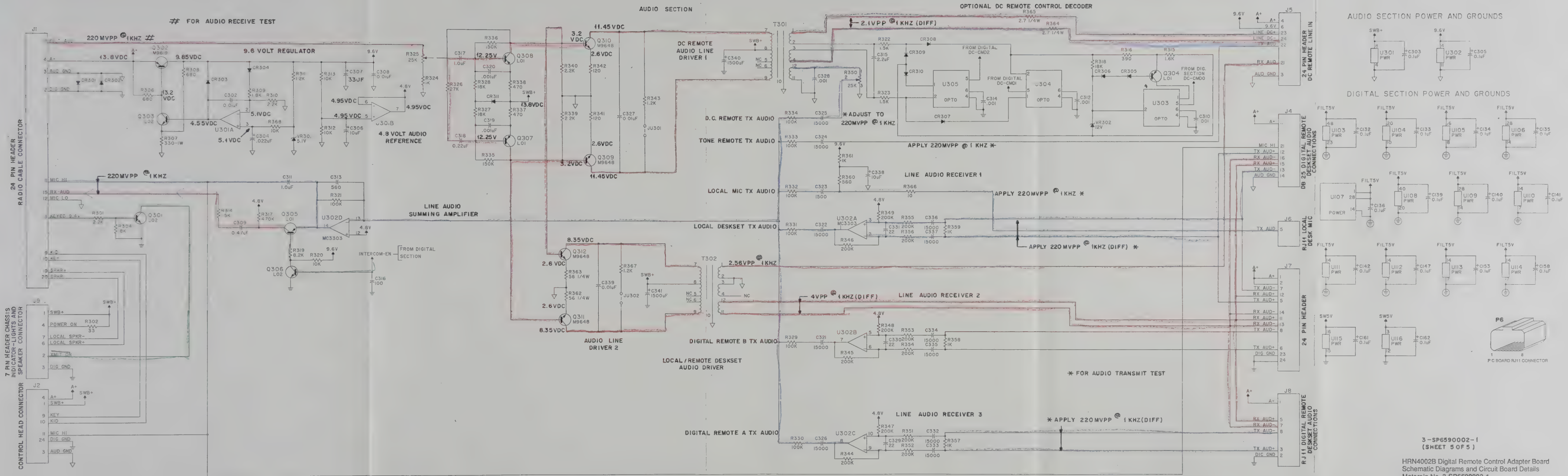


DIGITAL SECTION POWER AND GROUNDS



3-SP6590002-1
(SHEET 5 OF 5)

HRN4002B Digital Remote Control Adapter Board
Schematic Diagrams and Circuit Board Details
Motorola No. **3-SP6590002-1**
(Sheet 5 of 5)
2/14/90



PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF $\pm 5\%$; 50 V: unless otherwise stated
C101	2311048C10	10 $\pm 20\%$, electrolytic; 25 V
C102	2113740B56	200 pF
C103	2313749D71	4.7 $\pm 10\%$; tantalum
C104	2113740B56	200 pF
C105	2113740B57	220 pF
C106 thru 120	2113740B73	1000 pF
C121	2311048C05	1 $\pm 20\%$, electrolytic; 63 V
C122 thru 124	2113740B73	1000 pF
C126 thru 128	2113740B73	1000 pF
C129	2113740B29	15 pF
C130	2113740B73	1000 pF
C131	2113740B29	15 pF
C132 thru 137	2113741N69	100k
C138	2384538G06	47 $\pm 20\%$, tantalum; 20 V
C139 thru 142	2113741N69	100k
C143 thru 146	2113740B73	1000 pF
C147	2113741N69	100k
C148 thru 151	2113740B73	1000 pF
C152	2113740B49	100 pF
C153	2113741N69	100k
C154, 155	2113740B73	1000 pF
C156	2113740B33	22 pF
C157	2113740B73	1000 pF
C158, 159	2113741N69	100k
C160	2113740B73	1000 pF
C161, 162	2113741N69	100k
C163 thru 168	2113740B73	1000 pF
C169 thru 172	2311048C17	33 $\pm 20\%$, electrolytic; 32 V
C302	2113741N45	10 nF
C303	2113741N69	100k
C304	0811051A09	23 nF, polyester; 63 V
C305	2113741N69	100k
C306	2311048C10	10 $\pm 20\%$, electrolytic
C307	2311048C17	33 $\pm 20\%$, electrolytic; 32 V
C308	2113741N45	10 nF
C309	0811051A17	470 nF, polyester; 63 V
C310	2113740B73	1000 pF
C311	0811051A19	1, polyester; 63 V
C312	2113740B73	1000 pF
C313	2113740B67	560 pF
C314	2113740B73	1000 pF
C315	0882045F09	2.2, polyester; 250 V
C316	2113740B49	100 pF
C317	0811051A19	1, polyester; 63 V
C318	0811051A15	220 nF
C319, 320	2113740B73	1000 pF

PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C321 thru 326	2113741N49	15000 pF
C327	2113741N45	10000 pF
C328	2113740B73	1000 pF
C329 thru 331	2113740B33	22 pF
C332 thru 337	2113741N49	15000 pF
C338	2311048C10	10 \pm 20%, electrolytic; 25 V
C339	2113741N45	10000 pF
C340, 341	2384665F09	15 mF +150-10%; 25 V
<u>DIODE: (SEE NOTE)</u>		
CR103	4811058B11	silicon
CR301 thru 303	4811058B11	silicon
CR304	4811034A01	silicon, axial
CR305 thru 311	4811058B11	silicon
<u>CONNECTOR, receptacle:</u>		
J1 thru 3	2880085E27	24 pin header
J4	0980314B35	25 pin ("D" subminiature)
J5	2880085E27	24 pin header
J6	0980132M01	8 pin
J7	2880085E27	24 pin header
J8	0980132M01	8 pin
J9	2883143M01	7 pin header
<u>JUMPER:</u>		
JU101	0611009B23	2 pin
JU102 thru 107	2884318M07	3 pin
JU108	0611009B23	2 pin
JU109	2884318M07	3 pin
JU301, 302	0611009B23	2 pin
<u>INDUCTOR:</u>		
L101, 102	2482723H37	6.2 μ H
<u>TRANSISTOR: (SEE NOTE)</u>		
Q101	4880141L02	NPN, switching
Q102 thru 104	4880141L01	PNP, switching
Q105	4880141L02	NPN, switching
Q106	4880141L01	PNP, switching
Q107	4880141L02	NPN, switching
Q109, 110	4880141L01	PNP, switching
Q111	4880141L02	NPN, switching
Q112	4880141L01	PNP, switching
Q113	4880141L02	NPN, switching
Q114	4880141L01	PNP, switching
Q301	4880141L02	NPN, switching
Q302	4800869619	PNP, switching
Q303	4880141L02	NPN, switching

PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q304, 305	4880141L01	PNP, switching
Q306	4880141L02	NPN, switching
Q307, 308	4880141L01	PNP, switching
Q309 thru 312	4811043C07	NPN, audio power
<u>RESISTOR, fixed chip: $\pm 5\%$, 1/8 W:</u> unless otherwise stated		
R101, 102	0611077A98	1.5k
R103, 104	0611077A90	4.7k
R105, 106	0611077A50	100
R107, 108	0611077A82	2.2k
R109	0611077B15	47k
R110	0611077B11	33k
R111	0611077B07	22k
R112 thru 114	0611077B23	100k
R115	0611077B35	330k
R116	0611077A74	1.0k
R117	0611077B23	100k
R118	0611077A74	1.0k
R119	0611077B23	100k
R120, 121	0611077A98	1.5k
R123	0611077B23	100k
R125	0611077A98	1.5k
R126	0611077A90	4.7k
R128	0611077A50	100
R129, 130	0611077A98	1.5k
R131	0611077A50	100
R132	0611077A98	1.5k
R133	0611077A50	100
R134	0611077A98	1.5k
R135	0611077A50	100
R136	0611077A58	220
R137	0611077A98	1.5k
R138	0611077A50	100
R139	0611077A74	1.0k
R140	0611077A86	3.3k
R141	0611077A50	100
R142	0611077A90	4.7k
R143	0611077B15	47k
R144	0611077A50	100
R145	0611077A82	2.2k
R146	0611077A98	1.5k
R147	0611077B23	100k
R148	0611077B15	47k
R149	0611077A90	4.7k
R150	0611077A98	1.5k
R151	0611077A90	4.7k
R152 thru 154	0611077B05	18k

PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R155	0611077A90	4.7k
R156	0611077A81	2.0k
R159	0611077B47	1.0m
R160	0611077A58	220
R161	0611077A98	1.5k
R162 thru 166	0611077A58	220
R167 thru 174	0611077A98	1.5k
R176 thru 180	0611077A98	1.5k
R181	0611077A74	1.0k
R182, 183	0611077A82	2.2k
R184 thru 187	0611077A98	1.5k
R188, 189	0611077B15	47k
R190	0611077A98	1.5k
R191, 192	0611077B23	100k
R193 thru 196	0611077A82	2.2k
R197 thru 202	0611077A98	1.5k
R203 thru 205	0611077A85	3.0k
R206 thru 209	0611077A90	4.7k
R210 thru 213	0611077A66	470
R214, 215	0611077B23	100k
R216 thru 219	0611077A58	220
R220, 221	0611077B23	100k
R222 thru 225	0611077A66	470
R301	0611077A82	2.2k
R302	0611086A23	33, 1 W
R304	0611077B05	18k
R306	0611077A70	680
R307	0611086A47	330, 1 W
R308	0611077A70	680
R309	0611077A80	1.8k
R310	0611077A82	2.2k
R311	0611077A76	1.2k
R312, 313	0611077A98	10k
R314, 315	0611077A78	1.5k
R316	0611077A64	390
R317	0611077B39	470k
R318	0611077B05	18k
R319	0611077A96	8.2k
R320	0611077A98	10k
R321	0611077B23	100k
R322, 323	0611077A78	1.5k
R324	0611077A74	1.0k
R325	1884944C02	25k $\pm 20\%$, variable
R326	0611077B09	27k
R327, 328	0611077B05	18k
R329	0611077B23	100k
R330	0611077A98	10k
R331 thru 334	0611077B23	100k

PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R335, 336	0611077B27	150k
R337, 338	0611077A66	470
R339, 340	0611077A82	2.2k
R341, 342	0611077A52	120
R343	0611077A76	1.2k
R344 thru 349	0611077H18	200k $\pm 1\%$
R350	1884944C02	25k $\pm 20\%$, variable
R351 thru 356	0611077H18	200k $\pm 1\%$
R357 thru 359	0611077A74	1.0k
R360	0611077A68	560
R361	0611077A74	1.0k
R362, 363	0611009A19	56, 1/4 W; axial
R364, 365	0611009B26	2.7, 1/4 W; axial
R366	0611077A26	10
R367	0611077A76	1.2k
R368	0611077A98	10k
<u>TRANSFORMER:</u>		
T301, 302	2583036L01	audio
<u>INTEGRATED CIRCUIT: (SEE NOTE)</u>		
U101	5184561L76	5 V regulator
U102	5183222M81	voltage reference
U103	5190046A02	microcontroller
U104	5183808P04	8 bit latch
U105	5105133M03	3 x 8 decoder
U106	5184944N51	8k x 8 static RAM
U107	5190040B01	32k x 8 EPROM
U108	5184437N35	duart
U109	5190085A01	8k x 8 EEPROM
U110, 111	5183808P01	quad 2 input NANDs
U112	5183808P17	triple 3 input NANDs
U113	5184735R01	hex Schmitt triggered inverters
U114	5184786R01	quad 2 input ANDs
U115	5184704M88	tsc232cpe
U116	5184320A51	quad comparator
U301	5184621K85	dual bipolar op amps
U302	5184621K32	quad op amps
U303 thru 305	5184320A65	opto coupler
<u>VOLTAGE REGULATOR:</u>		
VR101 thru 108	4880140L11	7.5 V Zener
VR109 thru 112	0684357M02	150 V rms surge protector
VR301	4811034A10	5.1 V 1% Zener
VR302	4880140L17	12 V Zener
<u>CRYSTAL OSCILLATOR:</u>		
Y101	4880113K04	7.9488 MHz

PARTS LIST

REF SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		<u>NON-REFERENCED ITEMS:</u>
	0982808R10	28-PIN IC SOCKET
	0982808R04	16-PIN IC SOCKET
	2682271P01	HEAT SINK for U101
	0300001943	SCREW, heat sink
	0200131435	NUT, heat sink
	4310646A09	STANDOFF for J4
	0200131435	NUT for J4

NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

